the OIL AND GAS JOURNAL

JUNE 11, 1956

Automatic Custody Transfer

Here's how... It's a new technique which is destined to supplant the traditional gaging practices at many producers' run tanks. A 16-page special report.

p. 109

Hot Water Flood on Tap for Pembina

Project would give field 74,000,000 bbl. more reserves, extend life quarter century

P. 80

• Better Road Octane Results Are Coming. p. 88

It's More Than A Sign — It's A *symbol!..*

Continental's "Green Triangle" was created as a sign of identification. But it has become much more than that. It is now a symbol of personnel integrity and product supremacy. It signifies Continental's modernization program to keep abreast of the oil industry's expanding needs. Continental's service paces itself with the growth of the world's oil fields and is excelled only by the search for new and better equipment.

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A Glance Ahead . . . . at press time

These trends will make TOMORROW'S NEWS

A drilling rig that would streamline pipe-handling methods and eliminate some of the equipment found on present-day rigs is being studied. It would unify all operations within a two-story framework of a rotary drilling machine which supports and hoists the pipe, rotates and makes up the pipe, and breaks out and spins the joints.

Only a short, simple guyed pole and an air hoist would be needed for lifting and racking stands of pipe as they come out of the hole. The machine would take the place of such equipment as slips, tongs, spinning lines, catheads, and heavy crown and traveling blocks.

Air pollution studies will be brought a step nearer reality by a new device called a long-path infrared cell. This spectroscopic instrument will scan the atmosphere many times by using the principle of reflecting mirrors. It will identify and measure pollutants in extremely low concentrations. It has the advantage of studying contaminants in their natural proportions in air, where reactions differ from those found in concentrated lab studies.

Some natural-gas distributors are becoming more sympathetic to the position of producers. Transmission companies have turned down some of their requests for more gas. The pipelines explain it isn't available from the producers. If this more sympathetic understanding on the part of the distributors spreads, it may lead to more favorable legislation than the Harris-Fulbright bill next year.

The Supreme Court may act on the masters report in the California tidelands case before it adjourns.

The report, recommending how the state's 3-mile offshore boundary could run, has been on file since 1952. Its recommendations have met strong opposition from California officials because it throws parts of some bays into the federal area. Action by the court would settle one question—whether the whole thing is dead as a result of the 1953 Tidelands Act which gave back to California the offshore lands the federal Government claimed in 1947.

Refiners with well rounded processing facilities and with more knowledge regarding the most effective blending practices are lowering their signs as to costs per octane at the highest octane levels.

Research labs outside the oil industry emphasize that at the highest octane levels in motor fuels there should be maximum of paraffins and aromatics and a minimum of olefins in road tests. This points to more alkylation, isomerization, and reforming capacities at refineries.

Look for the first taker on pentane isomerization soon. A contract is expected to be signed shortly for a commercial unit to convert low-octane normal pentane and possibly normal hexane to the improved branched-chain isomers. The principal involved is very likely to be one of the bigger field-processing companies.

the OIL AND GAS JOURNAL

JUNE 11, 1956 • VOLUME 54 • NUMBER 58

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The Oil and Gas Journal, Published Mondays, copyright 1956, by The Petroleum Publishing Co. Entered as second-class matter September 1, 1910, at post office at Tulsa, Okla., under act of March 3, 1879. United States and foreign rates to the petroleum industry, 1 year $4, 2 years $7, 3 years $8.

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

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TECHNOLOGY—OPERATION

Refining—Processing

Why Limit Radiant Heat Input Rates? 133
By H. F. Lassner

In present design of radiant heaters, it is customary for the refiner to set a limit on the radiant-heat input rate. This is done to prevent overheating of the coil and possible costly furnace shutdown. Both supplier and user of process heaters would be better off if stringent limitations on radiant input rate were omitted from specifications. Some major refining companies are limiting the tube-wall temperature instead, as was originally intended.

On-The-Job-In The Plant: Improving Cycling Plant Operations 140
By Larry Resen

Operations at La Gloria Oil & Gas Co.'s Falfurrias, Tex., cycling plant are constantly improved by on-the-job study of methods and procedures. Some of the recent modificatitons include: (1) automatic sampler for a sales gas line, (2) a continuous blowdown system on the cooling tower, (3) utilization of residue-gas pressure in an expanding gas turbine, and (4) the application of corrosion resistant coatings.

Field Processing 149

Pipelining

Automatic Custody Transfer—A Special Section 109

Here is a special 16-page section on where we stand and where we are going with automatic custody transfer. Here for the first time is a step-by-step analysis of custody-transfer systems, giving the pros and cons of alternate methods where they exist.

Automatic custody transfer offers several advantages to both producer and pipeliner. By allowing a reduction in lease tankage, it will mean less evaporation loss and less money tied up in oil aboveground. It will improve accuracy in measuring volumes, lessen chance of errors, and probably simplify oil accounting and computing procedures. It means more efficient use of manpower, more efficient operation of gathering systems, and smoother pipeline load factors.

Pipeline Patrol: Construction 153

Drilling—Production

Automatic Custody Transfer 109

A step-by-step analysis of automatic custody transfer systems. This special 16-page section tells where we stand and where we are going with this new producing tool. Alternate methods are discussed when they exist.

Several advantages accrue to the producer on application of automatic custody transfer systems. There is less evaporation loss and less money tied up in oil above the ground because there is a decided reduction in lease tankage. Volumes can be measured more accurately with less chance for error. Oil accounting and computing procedures can be simplified.

Automatic Production Control of Marine Leases 129
By C. R. Bayless

Requirements for automatic production control of marine leases are vastly different from those onshore. Usually there is no commercial power, leases are difficult to reach, and corrosive conditions are encountered. In one installation, time-cycle controllers were eliminated, new high-pressure electric control valves were employed, and a pneumatic well shutin valve was used to eliminate the need for electric power at the wellhead.

Air Drilling Shallow Water-Flood Wells 144
By L. L. Brundred

A small rotary rig circulating air has met the need for 1-day drilling and completion of 400 to 600-ft. water-flood wells. Costs are no more than for cable-tool drilling and operations take only a third the time.

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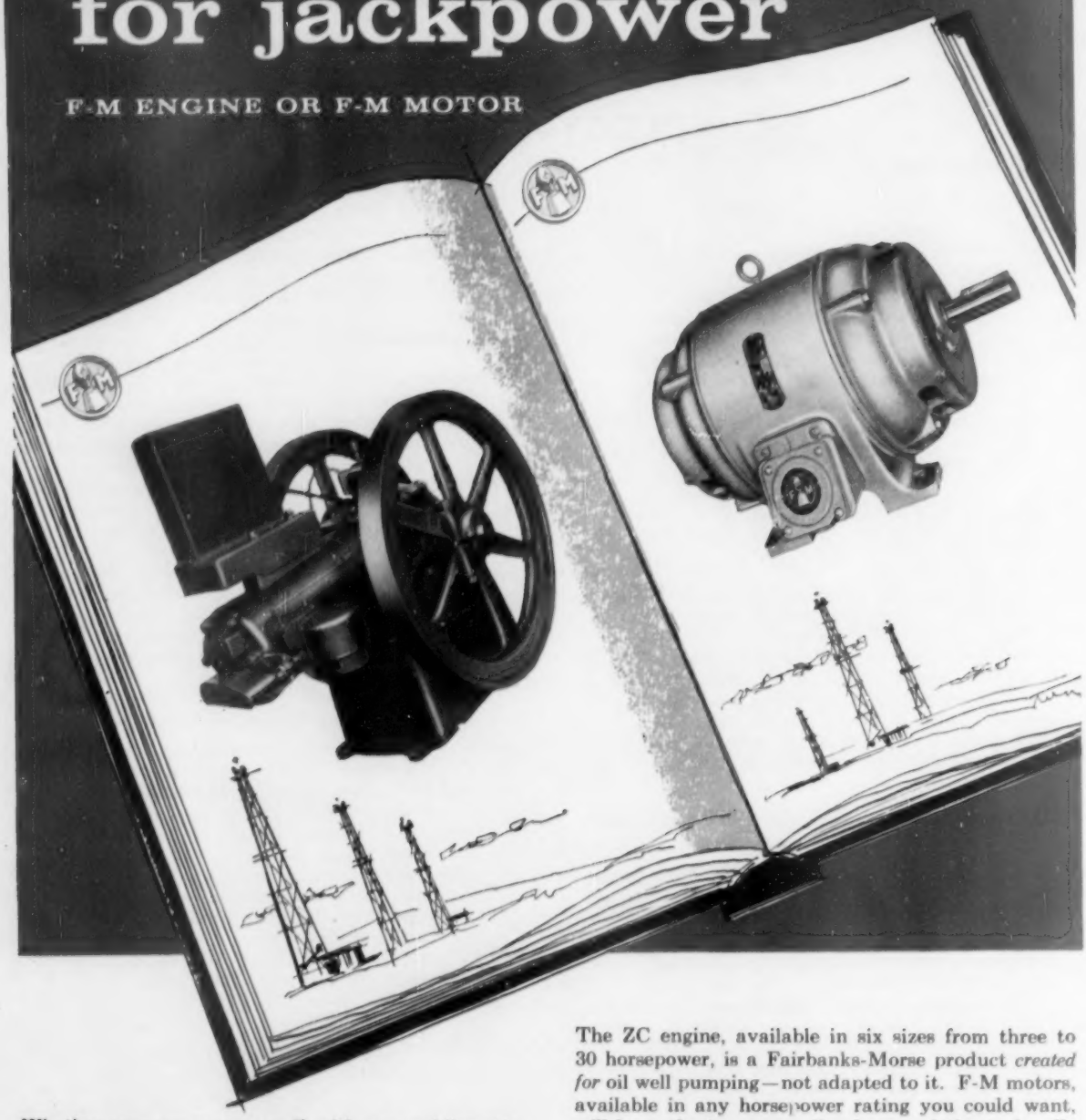

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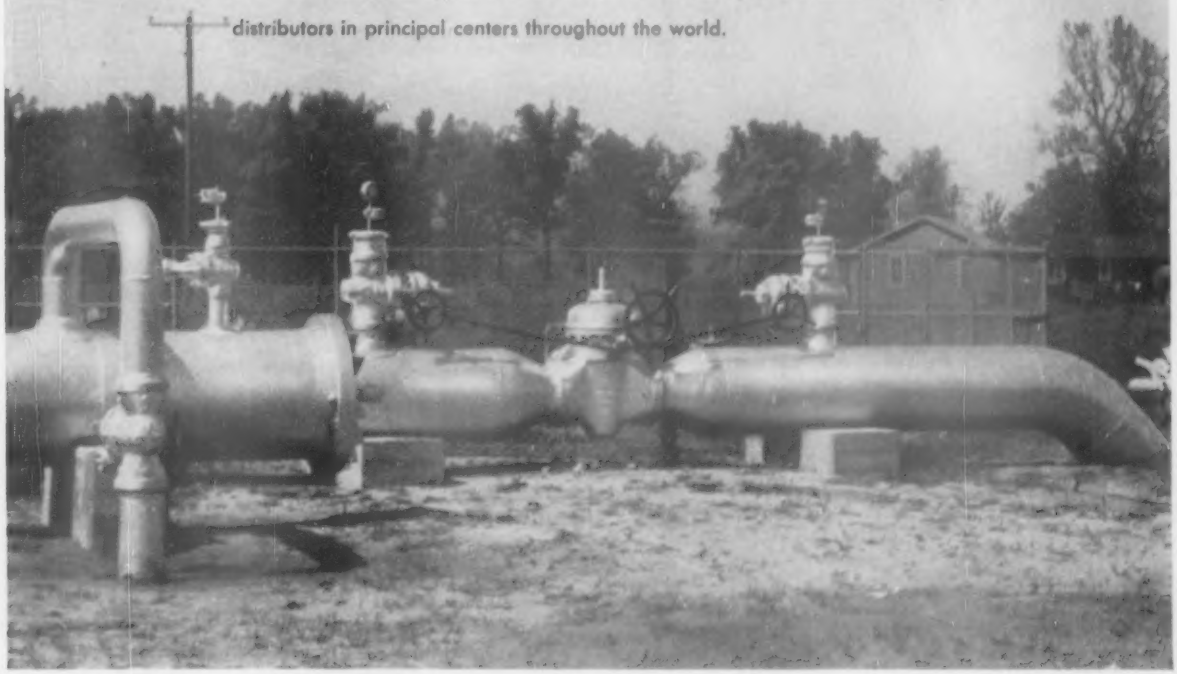

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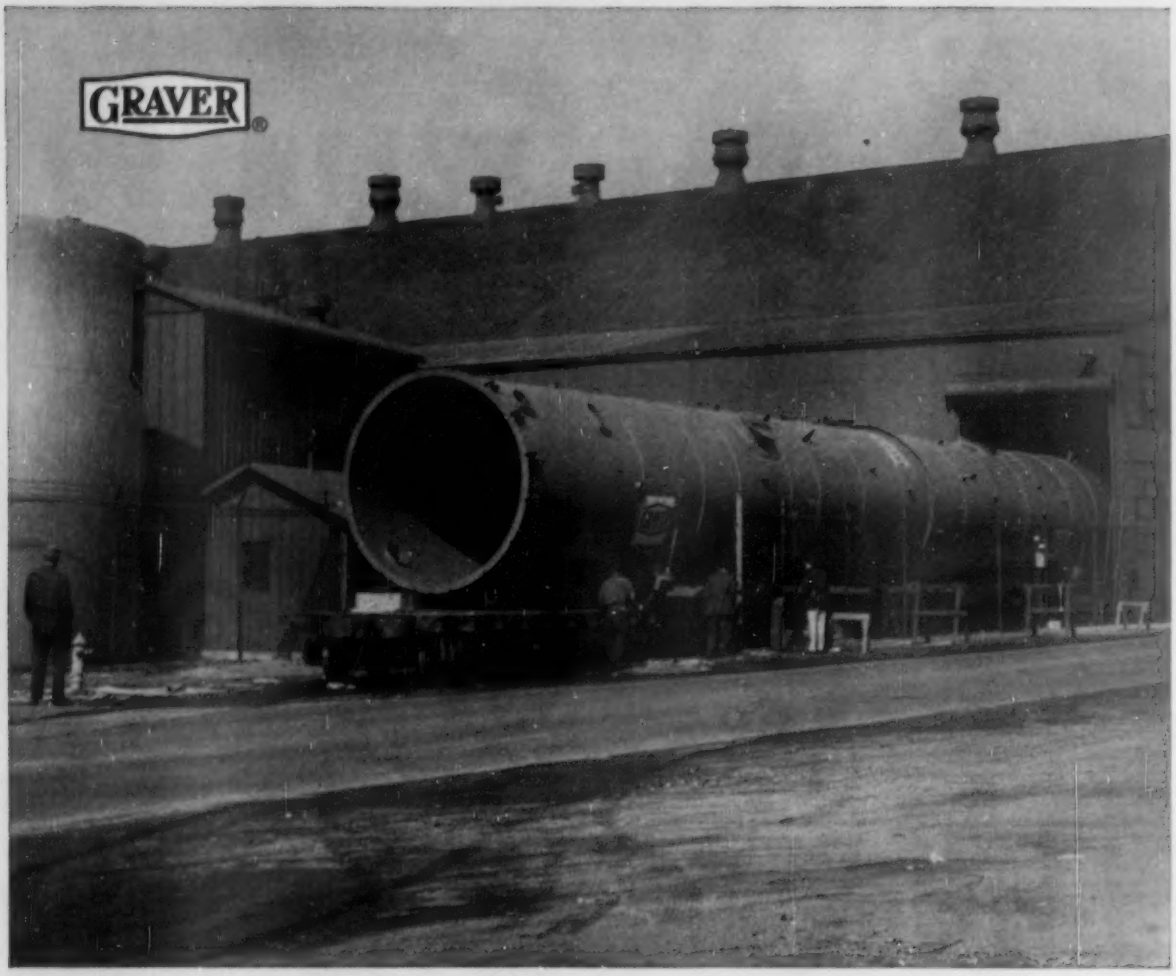

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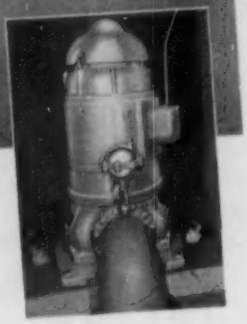

An unfailing, ever-dependable water supply is an absolute essential in producing the world-famous Sunshine biscuits.

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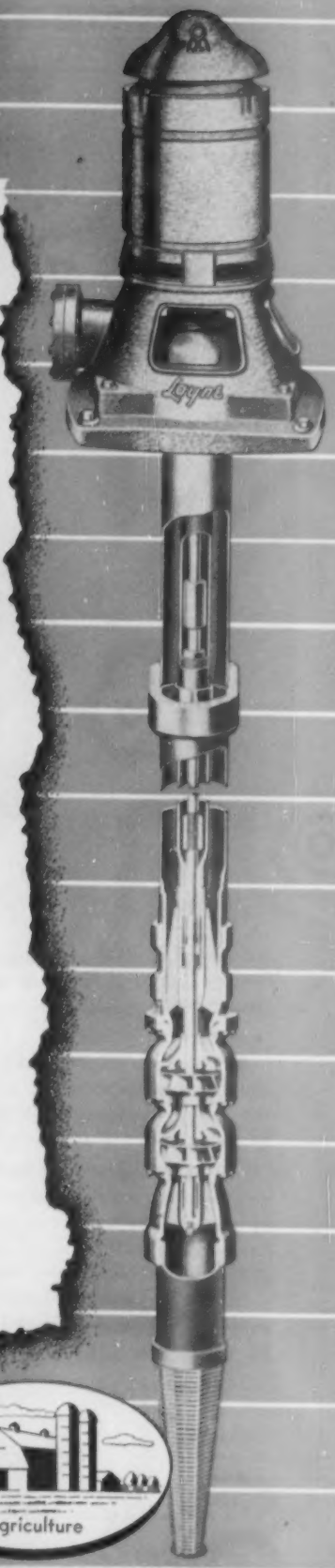

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C
A Long-life oil-, abrasion-, sun- and weather-resistant cover
B Reinforcement or wrapped plies of heavy fabric plus wire helix
C Tube resists abrasion, corrosion and oil

G.T.M. ups life of salt water disposal lines from months to years

ANYONE connected with oil wells using salt water injection knows the serious corrosion of steel pipe caused by the brine plus traces of acid. At one large company, the life of such lines was limited to a few short months.

As an answer to the problem, the G.T.M.—Goodyear Technical Man—advised replacing the pipe in the pump assembly with oil-resistant Diversipipe (see blueprint). This rubber pipe would eliminate electrolysis—permitting use of cast iron fittings—and would compensate for contraction, expansion and vibration so that plastic or concrete pipe could be used on the remainder of the line.

The first Diversipipe was installed almost two years ago. Today, it looks good as new—promises years' more service—has been followed by several other installations. And there were major savings in its ease of installation and elimination of the need for concrete platforms.

Your corrosion or materials handling problems may be similarly solved by the G.T.M. who has well over 800 types of hose to handle anything pumpable. You can contact him through your Goodyear Distributor or Goodyear, Industrial Products Division, Akron 16, Ohio.

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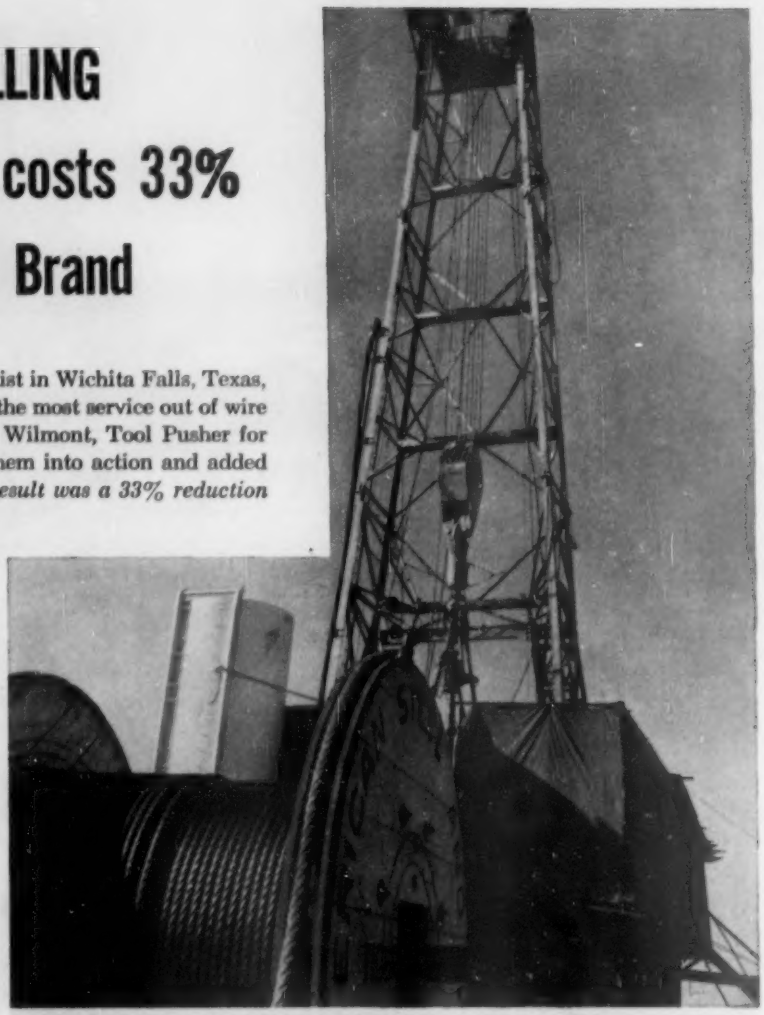
COX DRILLING
cuts wire rope costs 33%
with Tiger Brand

The Tiger Brand Wire Rope specialist in Wichita Falls, Texas, had some good ideas on how to get the most service out of wire rope. He discussed them with Ben Wilmont, Tool Pusher for Cox Drilling Company, who put them into action and added some more ideas of his own. *The result was a 33% reduction in wire rope costs.*



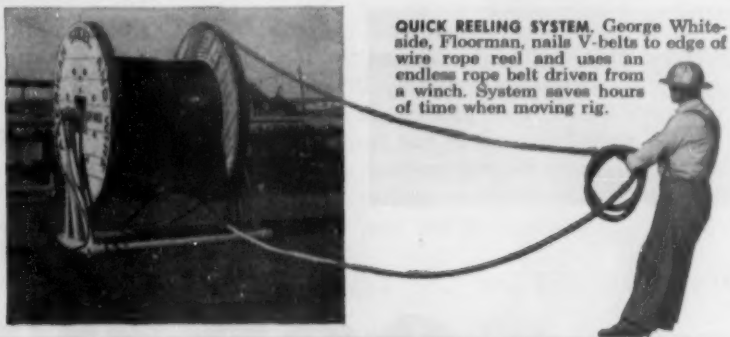
6000 FEET of Tiger Brand Wire Rope were used on the Cox Drilling Company Rig No. 3, Grayson County, Texas. This is double the usual amount.

HERE'S WHAT THEY DID—

1. They switched to the widely used Tiger Brand 1⅛" 6 x 19 Excellay Preformed Monitor Improved Plow Steel Drilling Line with IWRC.
2. Increased the length of rope from 3000 feet to 6000 feet.
3. Kept accurate ton-mile records.
4. Cut the rope back at *regular* intervals.
5. Used grooved drums.
6. Took care of the sheaves.
7. Handled the rope carefully. This included rigging up a special cradle for the line in reserve.

Mr. Wilmont says, "According to the ton-mile records, American Tiger Brand Wire Rope is the best we have ever used."

BILL GILBERT, DRILLER, checking the wear on wire rope.



QUICK REELING SYSTEM. George Whiteside, Floorman, nails V-belts to edge of wire rope reel and uses an endless rope belt driven from a winch. System saves hours of time when moving rig.

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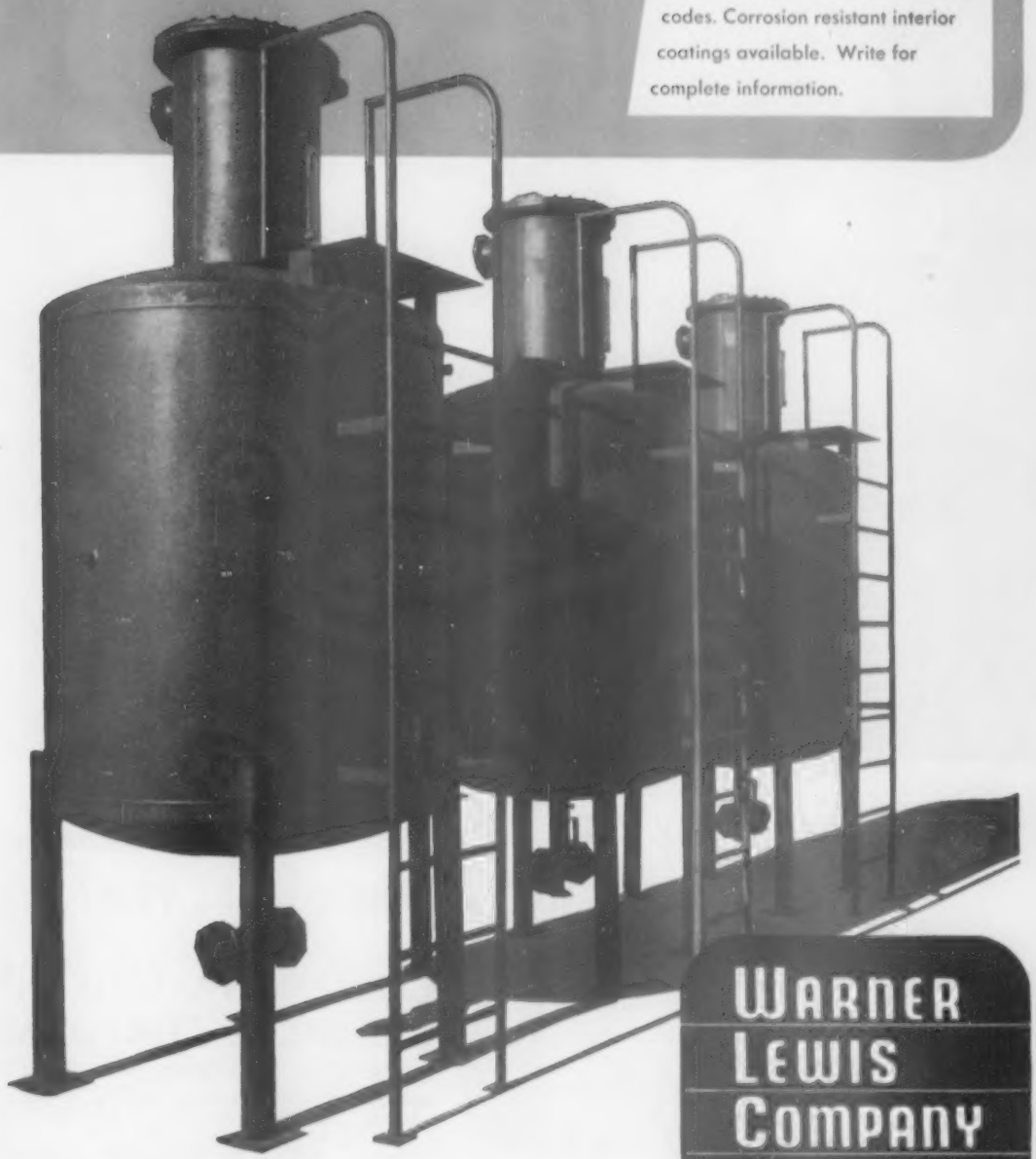

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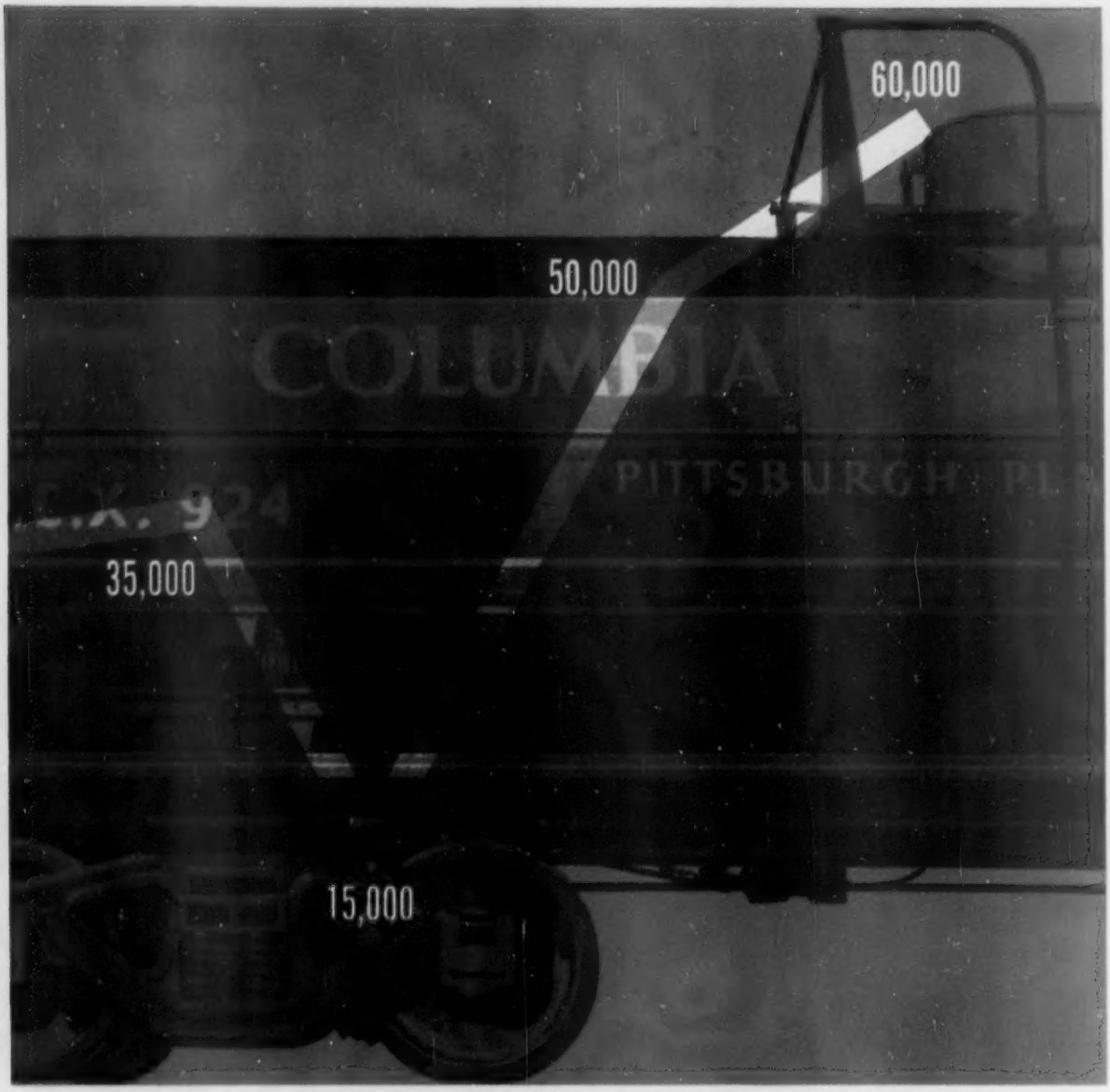

How many tank cars of liquid chlorine would you say were produced last year?

Total production of liquid chlorine by America's chemical industry in 1955 was an estimated 3,407,935 tons.

This represents an increase of 38% since 1950 and an increase of 65% since 1945.

Based on 55 ton capacity cars, last year's chlorine production was enough to fill a string of 61,962 tank cars.

Chlorine continues to grow. This year, Columbia-Southern remains the leading merchant producer of chlorine.

Columbia-Southern's sales, traffic, and technical departments are always ready and pleased to assist you with your chlorine problems.

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SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY

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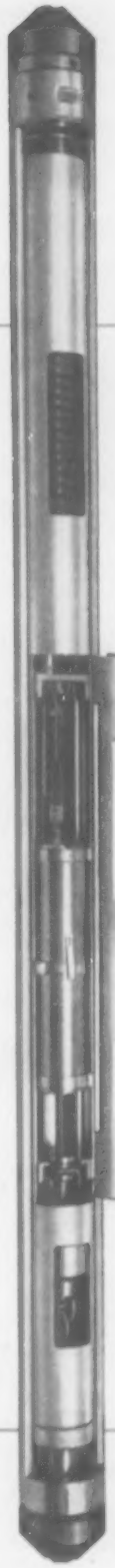
IN CANADA: Standard Chemical Limited and its Commercial Chemicals Division

PROVIDES MORE DRIVE PRESSURE DATA



HALLIBURTON DRILL STEM TEST!

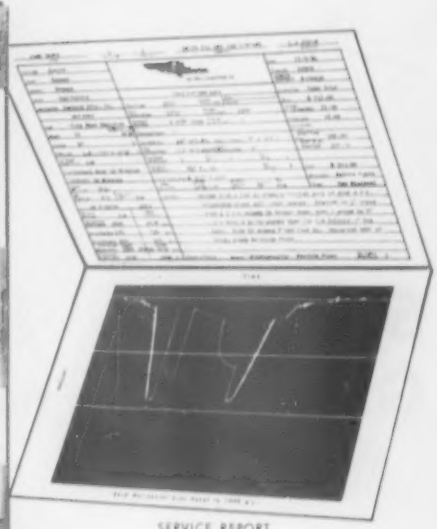
With BT Gauge Accuracy In Dual CIP Readings

New techniques in drill stem testing give oilmen vastly improved knowledge of their formation drive pressures. Halliburton's new Dual Closed In Pressure method gives far more detailed knowledge of well formation conditions. Accuracy and reliability of that information reaches a new high with the ultra-sensitive Bourdon Tube Gauge. No other pressure gauge now in use for well testing offers all these advantages:

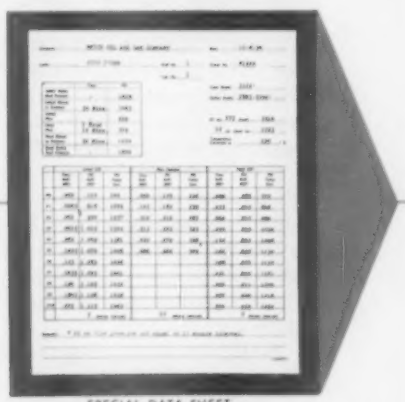
- *Negligible friction or lag*
- *Accurate within less than ½ of 1%*
- *Calibrated every sixty days by certified dead weight tester*
- *Pressure deflection readings made within 1/1000 inch*

Complete, more accurate information from Halliburton's Dual Closed In Pressure readings—with Bourdon Tube Gauge sensitivity—has enabled thousands of well owners to develop their wells for highly profitable production.

It's one of many reasons why Halliburton's best in drill stem testing. And all the benefits of a Halliburton test are available at far less than the cost of guessing wrong. So phone your local or district office of the Halliburton Oil Well Cementing Company.



SERVICE REPORT



SPECIAL DATA SHEET

COMPLETE DATA SENT ON REQUEST

Add this valuable information to your Halliburton Service File

HALLIBURTON TESTING SERVICE

250 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG

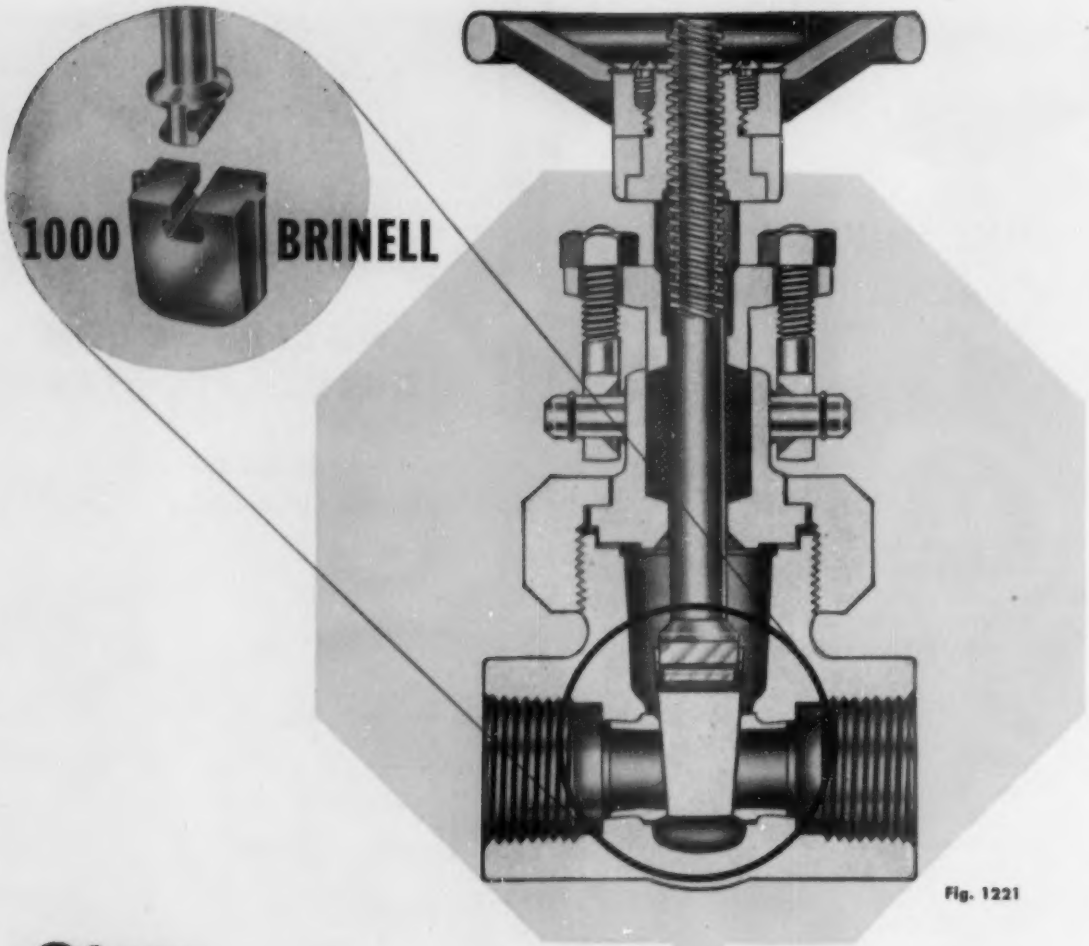


Fig. 1221

Stop Galling with the hardest valve wedges you can buy

OIC VALVES

FORGED & CAST STEEL,
BRONZE & IRON,
LUBRICATED PLUG VALVES

Highly resistant to erosion and corrosion

Here's a wedge as hard as flint . . . so hard that it's undamaged by pipe cuttings, scale or grit. It's the only trim we know of which will successfully withstand the simultaneous attack of the three valve-destroying agents—corrosion, erosion, galling. This wedge is *13% chrome stainless steel hardened up to 1000 Brinell.*

Specify the OIC 1221 gate or 1621 globe where you need the extra rugged nature of forged steel. They are recommended for steam service up to 800°F...oil service up to 1000°F. Or, use these same valves for hydraulic service up to 2000 lbs.

Write for Form 195 for specifications on the OIC forged steel line.

THE OHIO INJECTOR COMPANY
WADSWORTH, OHIO

See a working demonstration of Microballoon* spheres at Booth 406-408 World-Oil Exposition, Houston, Texas, April 25-29

The first manual to give the facts...

Based on field experience

This booklet, just published by Bakelite Company, covers the factors involved in the use of Microballoon* spheres made from BAKELITE Brand Phenolic Resins.

It is the first manual on this method of evaporation control to be based on reports from the field as well as the laboratory. It is a digest of the extensive experience that has accumulated up to the present time. The concise, easy-to-read text is supplemented and clarified by charts and tables of actual test results.

For your free copy, write Dept. OS-128.

Here is a list of subjects covered:

- Installation
- Packaging, receiving, shipping
- Crude storage tests
- Use of mixers
- Fire hazard
- Description of portable gage well
- Wall holdup

BAKELITE BRAND RESINS

*Registered trade-mark of The Standard Oil Company (Ohio)

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

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How to Put the Spurs to a Traveling Block

SpringKore

J&L SpringKore has sparked more interest than any other wire rope in the history of rotary drilling.

The core is a tightly coiled tough steel spring. It bends with less fatigue. It resists crushing, yet cushions the strands around it.

SpringKore starts you off right. You string up more readily because your line is more flexible. Your block falls straight, true, fast.

Under load, you have the feeling that everything is just right. You know that lubricant stored in the center of the core is fighting rust and wear. Around the drum and over the sheaves there is minimum distortion, instant recovery.

It's a great line — SpringKore. Let's talk about it; get your J&L store on the telephone!

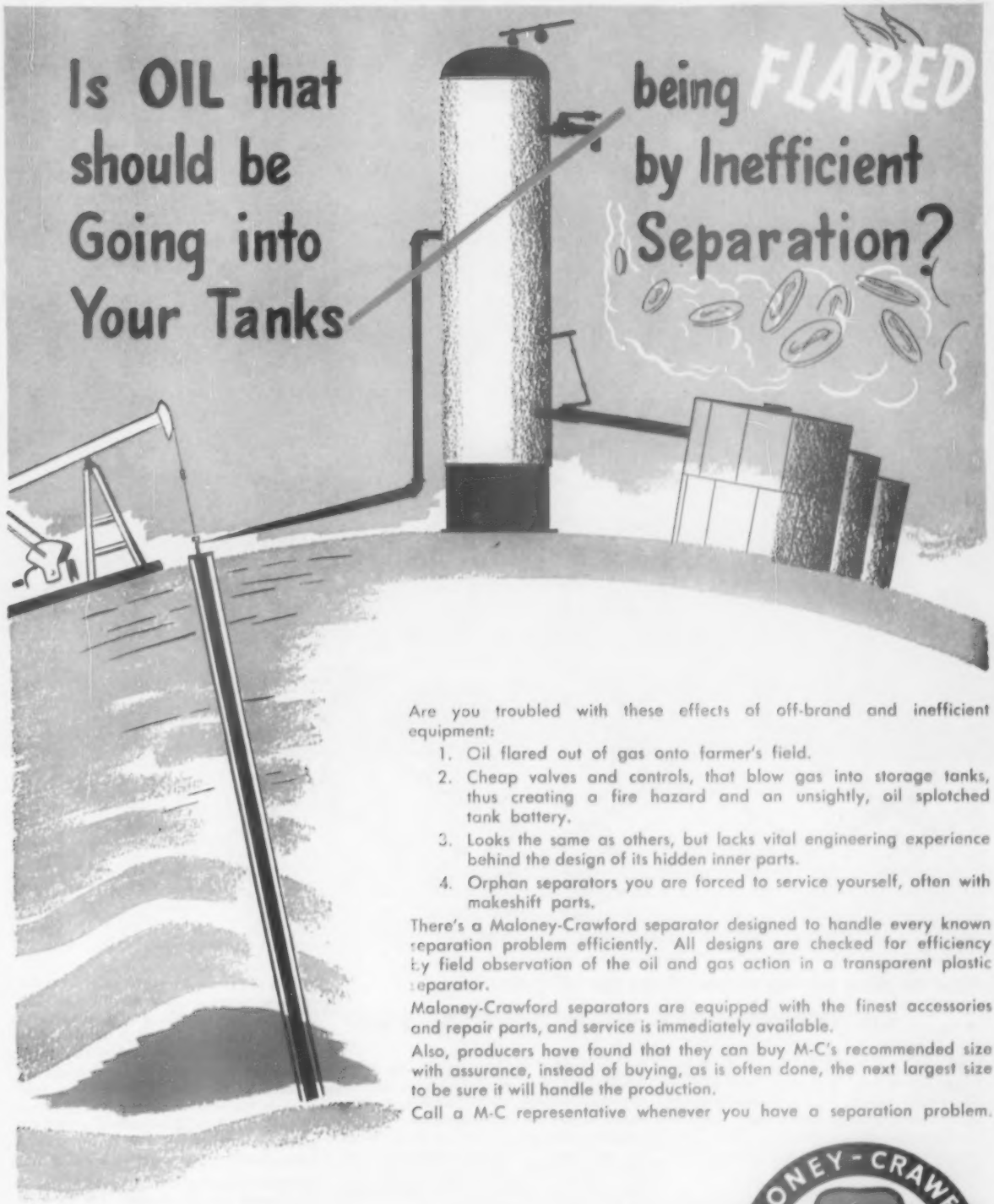
Jones & Laughlin

SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

J&L wire rope drills the world's deepest wells. The pride and interest of your J&L store follows a rotary line through every ton mile of dependable service.

9-S



Are you troubled with these effects of off-brand and inefficient equipment:

1. Oil flared out of gas onto farmer's field.
2. Cheap valves and controls, that blow gas into storage tanks, thus creating a fire hazard and an unsightly, oil splotched tank battery.
3. Looks the same as others, but lacks vital engineering experience behind the design of its hidden inner parts.
4. Orphan separators you are forced to service yourself, often with makeshift parts.

There's a Maloney-Crawford separator designed to handle every known separation problem efficiently. All designs are checked for efficiency by field observation of the oil and gas action in a transparent plastic separator.

Maloney-Crawford separators are equipped with the finest accessories and repair parts, and service is immediately available.

Also, producers have found that they can buy M-C's recommended size with assurance, instead of buying, as is often done, the next largest size to be sure it will handle the production.

Call a M-C representative whenever you have a separation problem.

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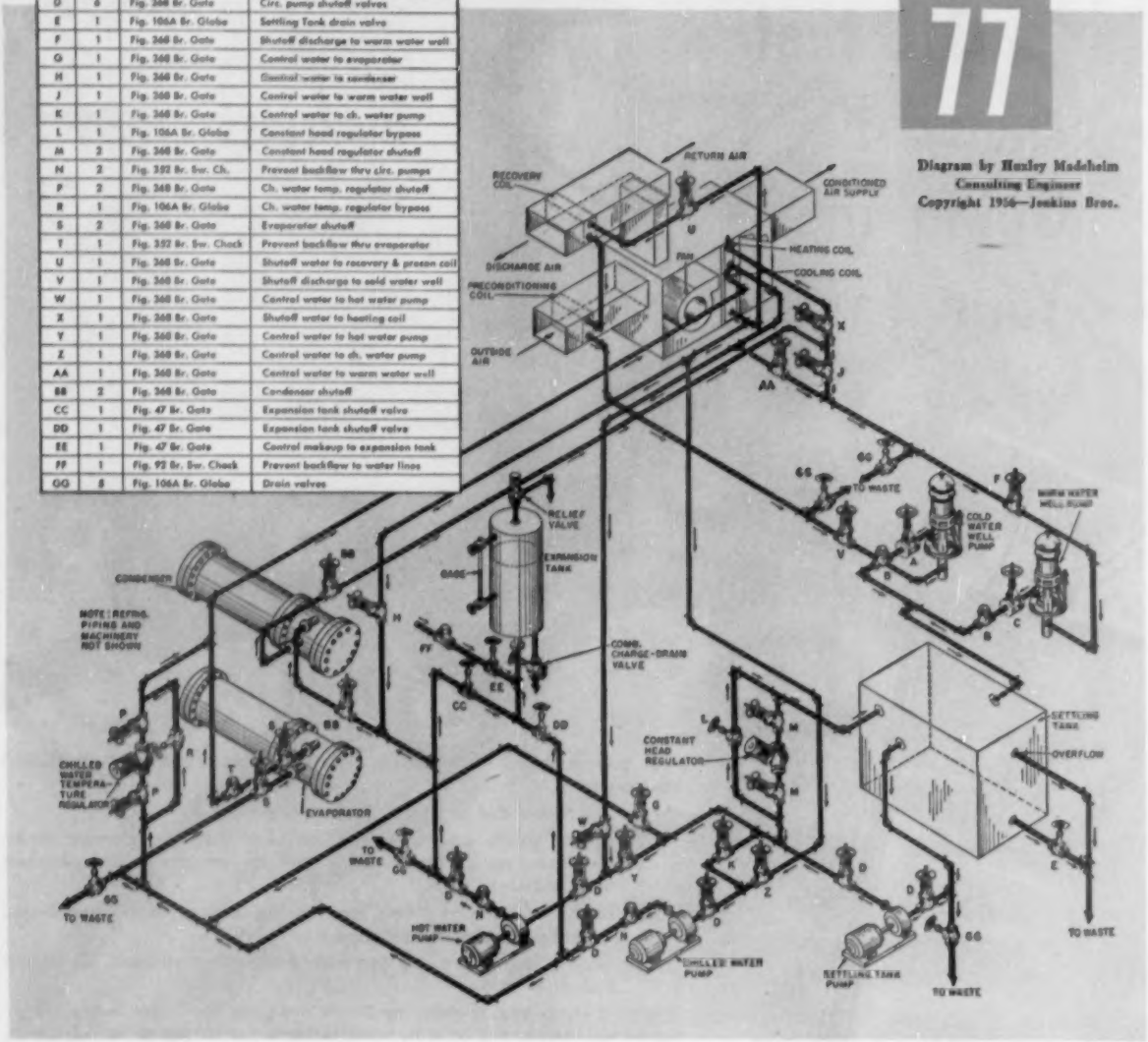
JENKINS PRACTICAL PIPING LAYOUTS

77

Diagram by Huxley Madeheim
Consulting Engineer
Copyright 1956—Jenkins Bros.

Code	Quan.	Jenkins Valve	Service
A	1	Fig. 577A Br. Gate	Cold water well shutoff valve
B	2	Fig. 395 Br. Sw. Check	Prevent backflow thru well pumps
C	1	Fig. 677A Br. Gate	Warm water well shutoff valve
D	6	Fig. 368 Br. Gate	Circ. pump shutoff valves
E	1	Fig. 106A Br. Globe	Settling Tank drain valve
F	1	Fig. 368 Br. Gate	Shutoff discharge to warm water well
G	1	Fig. 368 Br. Gate	Control water to evaporator
H	1	Fig. 368 Br. Gate	Control water to condenser
J	1	Fig. 368 Br. Gate	Control water to warm water well
K	1	Fig. 368 Br. Gate	Control water to ch. water pump
L	1	Fig. 106A Br. Globe	Constant head regulator bypass
M	2	Fig. 368 Br. Gate	Constant head regulator shutoff
N	2	Fig. 352 Br. Sw. Ch.	Prevent backflow thru circ. pumps
P	2	Fig. 368 Br. Gate	Ch. water temp. regulator shutoff
R	1	Fig. 106A Br. Globe	Ch. water temp. regulator bypass
S	2	Fig. 368 Br. Gate	Evaporator shutoff
T	1	Fig. 352 Br. Sw. Check	Prevent backflow thru evaporator
U	1	Fig. 368 Br. Gate	Shutoff water to recovery & precon coil
V	1	Fig. 368 Br. Gate	Shutoff discharge to cold water well
W	1	Fig. 368 Br. Gate	Control water to hot water pump
X	1	Fig. 368 Br. Gate	Shutoff water to heating coil
Y	1	Fig. 368 Br. Gate	Control water to hot water pump
Z	1	Fig. 368 Br. Gate	Control water to ch. water pump
AA	1	Fig. 368 Br. Gate	Control water to warm water well
BB	2	Fig. 368 Br. Gate	Condenser shutoff
CC	1	Fig. 47 Br. Gate	Expansion tank shutoff valve
DD	1	Fig. 47 Br. Gate	Expansion tank shutoff valve
EE	1	Fig. 47 Br. Gate	Control makeup to expansion tank
FF	1	Fig. 92 Br. Sw. Check	Prevent backflow to water lines
GG	8	Fig. 106A Br. Globe	Drain valves



How to plan piping connections for all-year

AIR CONDITIONING WITH THE HEAT PUMP

Well water is used in the basic heat pump installation illustrated. Such a system could readily serve a building with several exterior and interior zones, which would have many air handling units. For simplicity, only one unit is shown in the diagram.

For heating demands, this system provides a closed circuit consisting of hot water pump, condenser, and heating coil. For cooling, a second closed circuit consists of chilled water pump, evaporator, and cooling coil.

During the heating season, water is supplied to the settling tank from the warm water well (about 60° F). It is circulated by the chilled water pump to the evaporator, and then to the cooling coil to provide cooling, where needed, for interior areas. The water then flows to the recovery coil, picks up heat from waste air and carries it to preconditioning coil, where it is used to preheat outside air. The resulting chilled water is discharged to the cold water well.

During the intermediate seasons, water is supplied to the settling tank from the cold water well (about 50° F). It is circulated by the hot water pump to the condenser, and then to the heating coil to provide heat, where needed, for the exterior zones. The water is then discharged to the hot water well.

During the cooling season, water from the cold water well is pumped to the settling tank, and then circulated to the evaporator and the cooling coils. It is next used to cool the condenser, and is then discharged to the hot water well. If the demand for cooling is low, and the well water cold enough, the evaporator may be bypassed.

Consultation with accredited piping engineers and contractors is recommended when planning major piping installations.

Enlarged diagram and full description of this layout free on request. Ask for Layout No. 77. Jenkins Bros., 100 Park Ave., New York 17.

JENKINS VALVES
LOOK FOR THE JENKINS DIAMOND

SOLD THROUGH PLUMBING-HEATING AND INDUSTRIAL DISTRIBUTORS

HOUSTON NATURAL GAS CORPORATION ODEM FIELD COMPRESSOR STATION—equipped with two Beaird-Ingersoll-Rand 660 h.p. 12SVG four cycle gas engine driven compressors, Young radiators, lubricating oil coolers and gas coolers, and all necessary controls. Other sizes 110 to 660 h.p.

Quick Installation –

PACKAGED COMPRESSORS SUPPLY NEEDED RESERVES

Houston Natural Gas Corporation built this compressor station in Odem Field, Texas, to boost natural gas to lines serving the expanding Corpus Christi area. Equipped with two 660 h.p. Beaird-Ingersoll-Rand 12SVG packaged units, it is capable of handling 12 mmcfd. Utilizing packaged compressors minimized field assembly and added needed reserves at a saving in both time and cost of installation.

Operating with two stages of compression, the units pick up gas from nearby wells at 50 psig. and boost it to the line at 325 psig. Automatic controls built into the compressors prevent suction pressures from being pulled below 50 psig. required for efficient operation of the separators. Flexible in design, the units can be converted to three-stage compression to follow the pressure on down as the field grows older. When reserves are depleted the compressors can be moved to other service and nearly all of the present installation salvaged for re-use at the new location.

Let us show you how complete packaging simplifies installation and reduces field assembly costs.

THE J. B. BEAIRD COMPANY, INC.

Shreveport, Louisiana

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MANUFACTURING
STEEL WAREHOUSE

BEAIRD

PACKAGED COMPRESSOR PLANTS

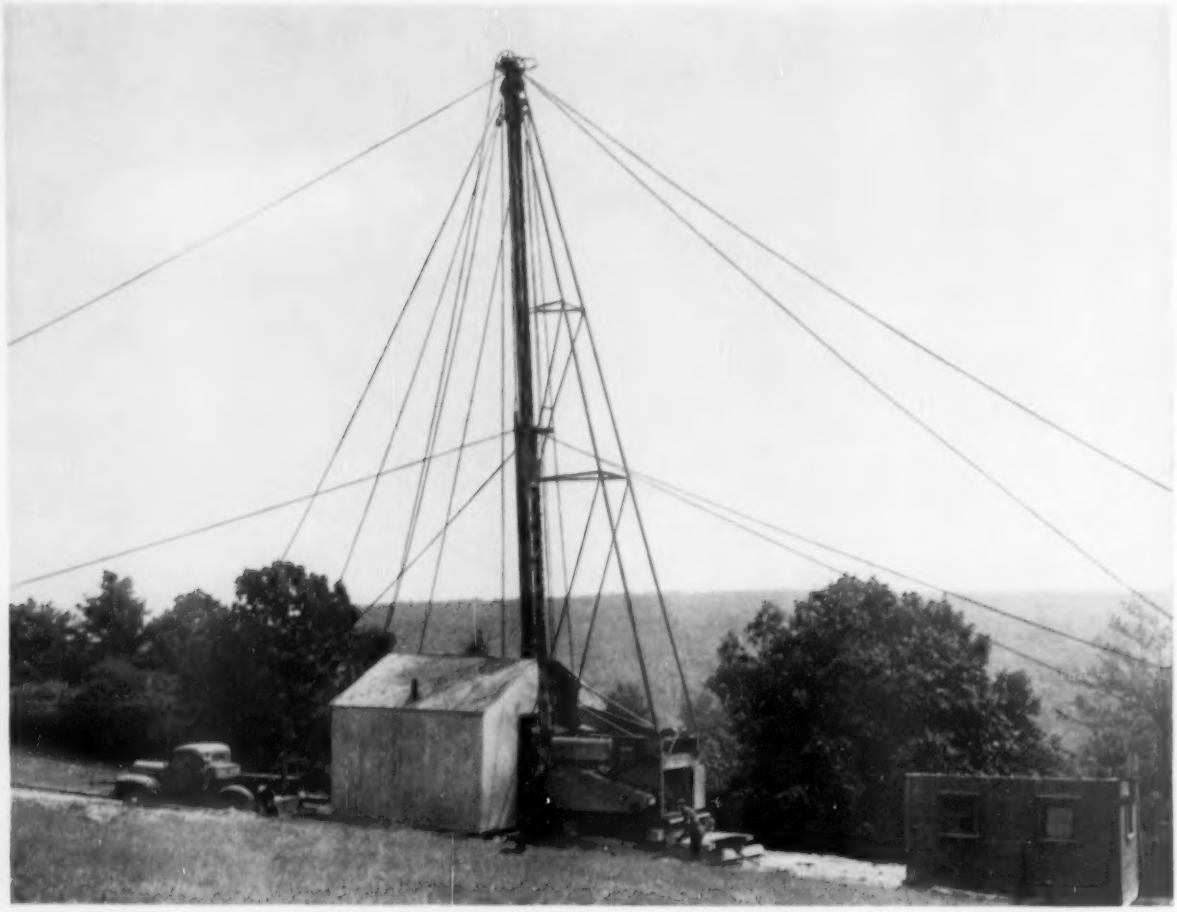
CAST STEEL FITTINGS

PRESSURE BULK STORAGE

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS

Sales offices: *Dallas, Houston, Corpus Christi and Midland, Texas; Tulsa, Oklahoma; Denver, Colorado; Los Angeles, California, and Cie. Ingersoll-Rand, Paris, France.*



Why BUCYRUS-ERIE Spudders pay off on Secondary Recovery

Bucyrus-Erie spudders offer the speed and mobility you need for fast, profitable secondary recovery operations. These modern rigs assure rapid progress hole after hole, with quick easy moves and reduced costs all down the line.

You can't beat the *speed* with which Bucyrus-Eries put down hole. Snappy spudding action, with shock absorber that can be blocked out for deep drilling, means real drilling speed in any formation. Forward and reverse speeds on all reels and on the catheads provide the accurate, split-second control that diversified operations require. Reels are free-wheeling for lowering. Fast powerful line pulls result in fast trips in handling tools, bailer, casing, or rods in clean-out work.

And when it comes to moves, Bucyrus-Eries really save time. Their telescoping derricks are lowered and raised quickly under power, tubular braces unfold smoothly. Mobile semi-trailers or skid mountings make *moving* easy.

Two popular choices for secondary recovery work are the 60-L and 28-L machines. For complete information on them, see the Bucyrus-Erie spudder distributor in your area or write us direct. 30556

60-L Top-to-bottom drilling to 1,500 ft.;
Servicing to 2,000 ft.;
Swings up to 2,750 lbs. of tools.

28-L Top-to-bottom drilling to 2,500 ft.;
Servicing to 3,000 ft.;
Swings up to 3,700 lbs. of tools.

BUCYRUS ERIE

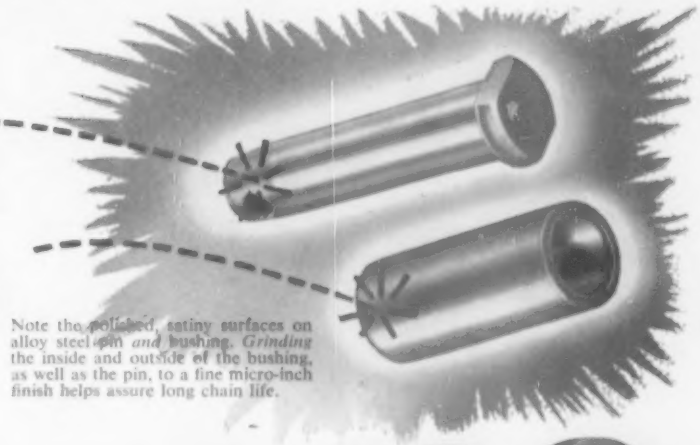
SOUTH MILWAUKEE, WISCONSIN

FIRST with the FINEST in SPUDDERS

Cie. Ingersoll-Rand, Paris, France.

Quick check on API chain quality:

Look at pins and bushings



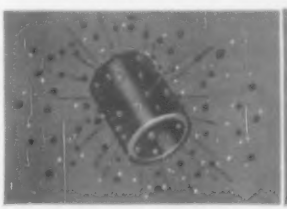
Note the polished, satiny surfaces on alloy steel pin *and* bushing. *Grinding* the inside and outside of the bushing, as well as the pin, to a fine micro-inch finish helps assure long chain life.

LINK-BELT grinds both —eliminates wear-producing surface irregularities

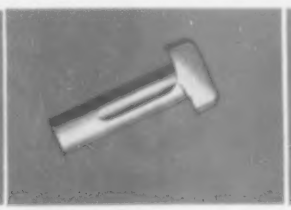
FOR true chain precision and maximum endurance, appearance grinding is not enough. In the machining of pins and bushings for Link-Belt API chains, nicks and tool marks which may be starting points of fatigue are eliminated. Then, too, Link-Belt cadmium plates the pins to prevent rust and to avoid corrosive fatigue in these flexing members. These cadmium-plated pins go into service in factory-finish condition no matter how long the chain is stored.

Link-Belt API (SS type) chains have unequalled distribution throughout the oil country . . . and distributors are backed up by strategically located Link-Belt warehouses. These leading supply stores can show you why Link-Belt API chain is first choice in the field. And ask for a copy of Catalog 2680 on the broad Link-Belt line of oil field equipment. Or call your nearest Link-Belt office.

3 of many "EXTRAS" you get as standard on Link-Belt API chain



SHOT-PEENED rollers hammered by steel balls have added impact resistance.



COTTERS with patented grooved shank fit tightly in pin hole. Pin is easily removed.

MORE CONVENIENT. Dust-proof, sturdy boxes simplify handling, identification.

LINK-BELT

CHAINS AND SPROCKETS

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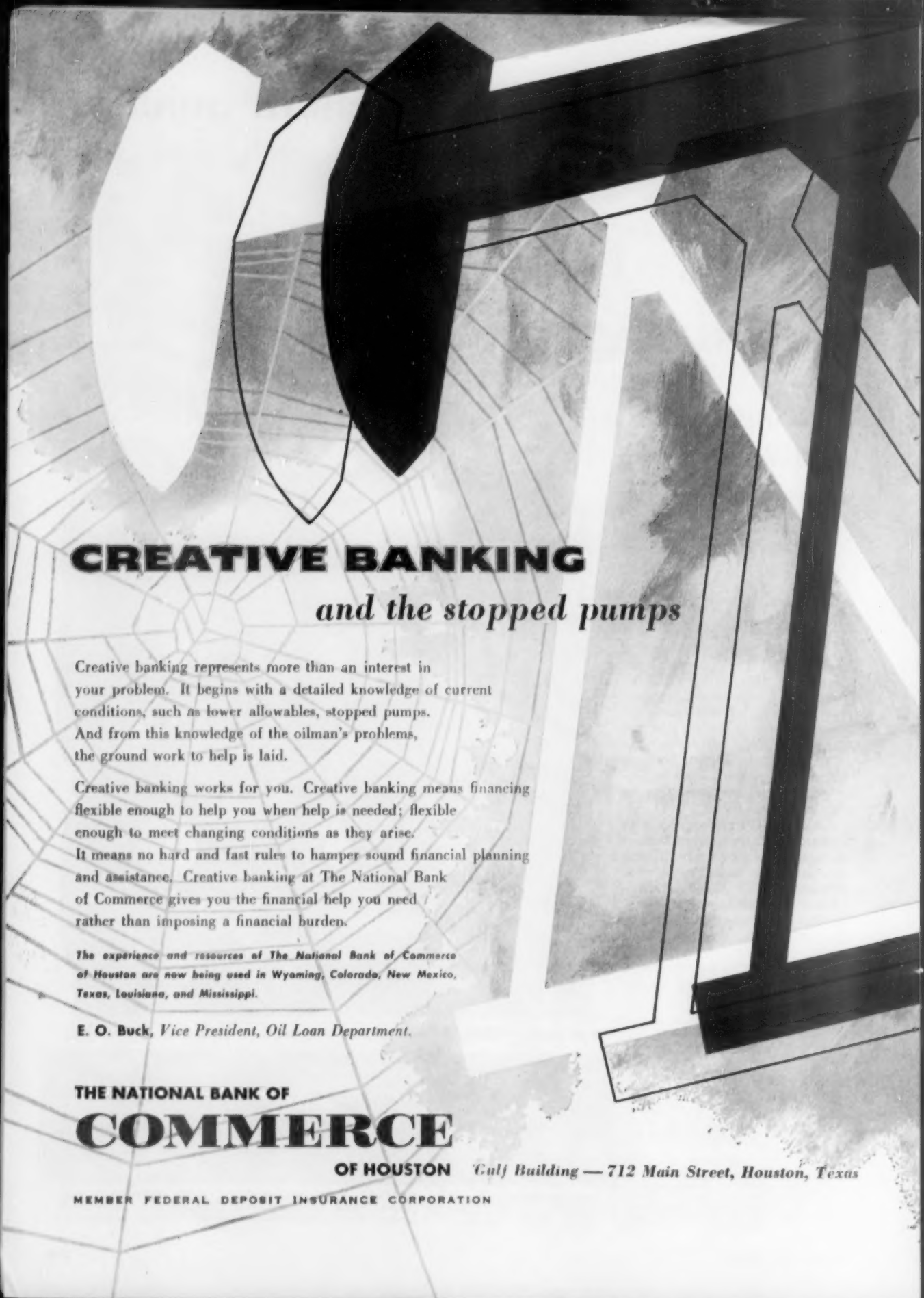

CREATIVE BANKING

and the stopped pumps

Creative banking represents more than an interest in your problem. It begins with a detailed knowledge of current conditions, such as lower allowables, stopped pumps. And from this knowledge of the oilman's problems, the ground work to help is laid.

Creative banking works for you. Creative banking means financing flexible enough to help you when help is needed; flexible enough to meet changing conditions as they arise. It means no hard and fast rules to hamper sound financial planning and assistance. Creative banking at The National Bank of Commerce gives you the financial help you need rather than imposing a financial burden.

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E. O. Buck, *Vice President, Oil Loan Department.*

THE NATIONAL BANK OF

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OF HOUSTON *Gulf Building — 712 Main Street, Houston, Texas*

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Bethlehem's drop forge shops are ready for you—always!

You can depend upon us for volume production. Even more important, you have the assurance of expert workmanship. Unless you have been through the Bethlehem shops, it is hard to visualize their full extent and the care with which each step in an order is handled.

Bethlehem produces an almost endless variety of designs for the oil, mining, aviation, automotive, electrical, and other industries. This is made possible by strictly first-class facilities, which include a modern die-sinking plant, steam and board drop hammers to 8,000 lb, mechanical presses to 3,000 tons, upsetters to 9 in., and full heat-treating equipment.

We're anxious to do business with you. Why not call us when you are next in the market for closed-die forgings? You'll find our prices and deliveries are fully competitive.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

34" full opening high pressure gas line valve—biggest ever built

This Grove Seal-O-Ring Gate Valve with the rugged fabricated steel body design is actuated by a hydraulic piston operating on pressure from the line.

THE WHOLE VALVE IS RIGHT HERE

When valve is full open or closed, bubble-tight seals on both sides of the gate completely isolate line pressure in the conduit. The body, serving merely as framework for operating mechanism and to prevent loss of product while gate is in motion, may be drained or vented to atmosphere when gate is open or closed. Integrity of seals can be checked any time by a tell-tale valve on the body.

602

GROVE SEAL-"O"-RING Gate Valves

GROVE VALVE and REGULATOR COMPANY • 65th & Hollis Sts., Oakland 8, California
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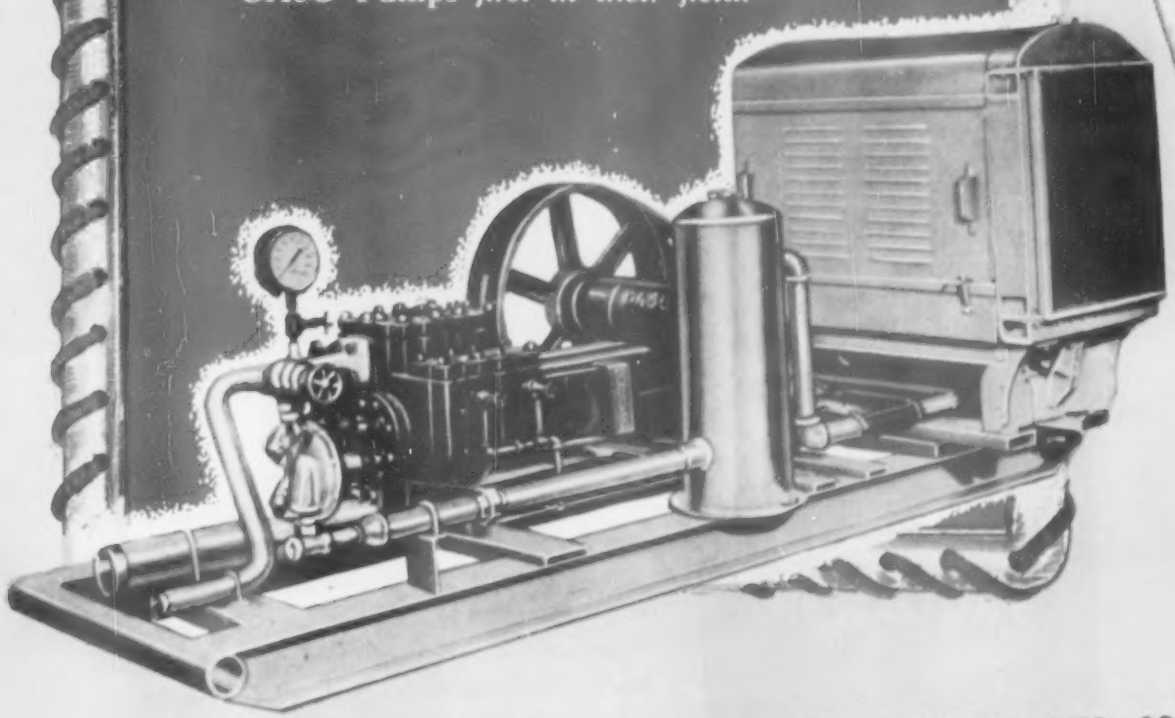
GROVE SEAL O RING GROVE SIMPLICITY ACCURACY SAFETY

2 × 2 = 4 Simple Arithmetic!

Pumps that deliver *top* performance for *longer* periods of time yield a *bigger* return on the investment. That's what makes GASO Pumps *first in their field.*



SERIES 1800—Light, compact, for crude oil gathering lines and booster stations, water lines, salt water disposal, slush and acidizing service. Fig. 1849: 41 to 113 GPM at 900 to 350 PSI. Fig. 1847: 41 to 143 GPM at 900 to 275 PSI. Fig. 1845: 254 to 370 GPM at 220 to 150 PSI.

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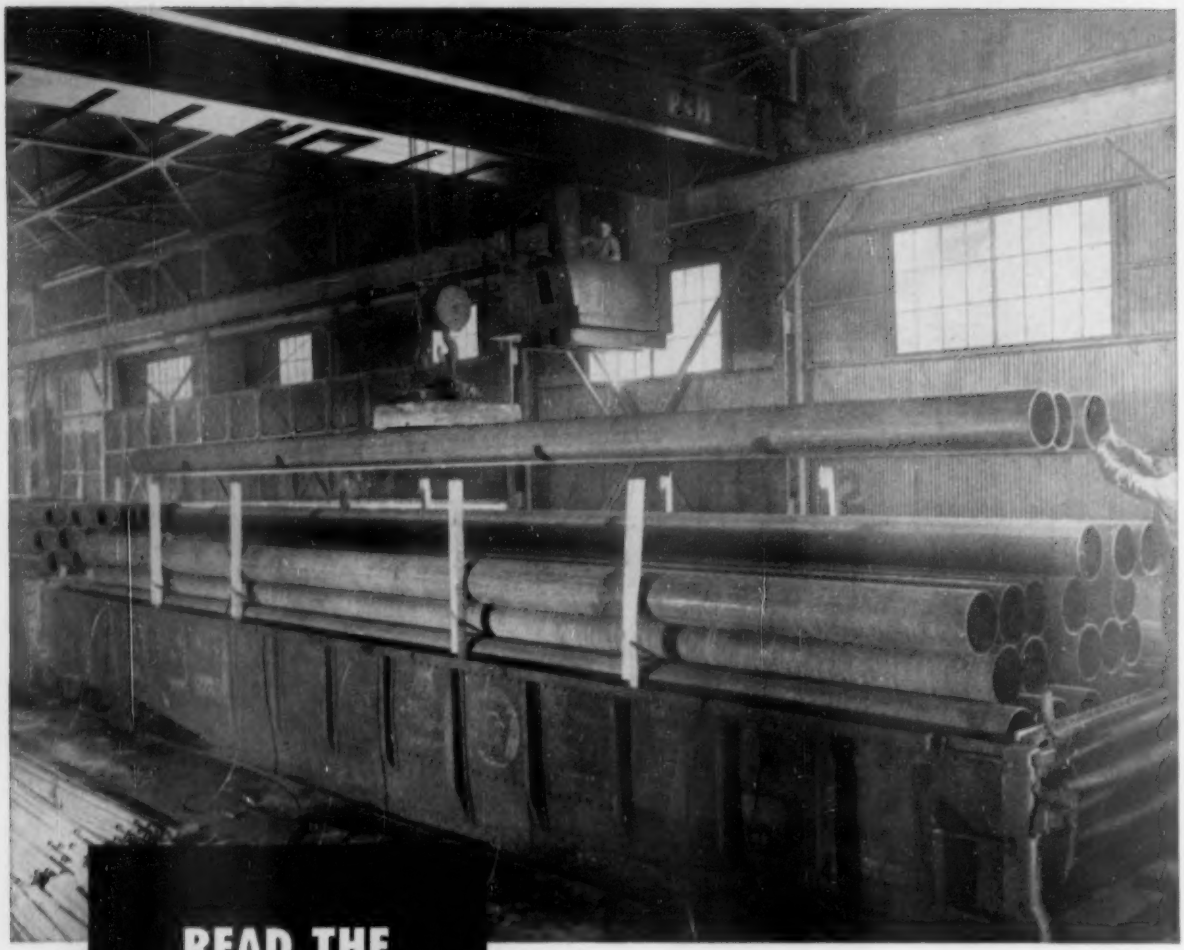
GET GASO DEPENDABILITY IN WATER FLOODING, TOO



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The great outdoors is no place to coat and wrap pipe. It rains. The weather changes. It's too hot or too cold. It's too wet or it's too dry. That's why the pipe you see above is *indoors*...in a HILL, HUBBELL factory where it will be machine-cleaned, coated and wrapped, under precisely controlled conditions of temperature and processing. HILL, HUBBELL had the know-how to *develop* the factory system of pipe coating and wrapping. Like so many of the forward strides in pipe protection, it is—

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FACTORY APPLICATORS OF COATINGS & WRAPPINGS

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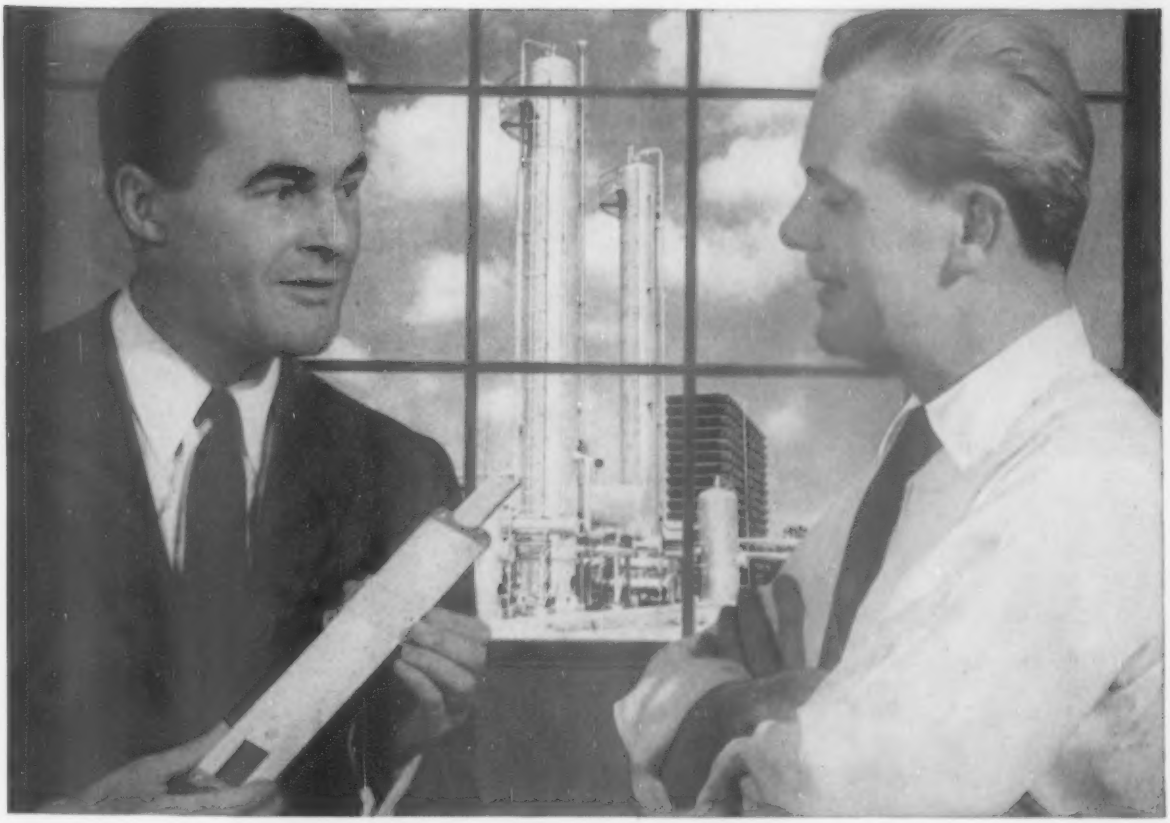

You get more than gas treating chemicals from CARBIDE...

CARBIDE'S mono- or diethanolamine give you excellent removal of CO_2 and H_2S. By converting the extracted H_2S to sulfur or H_2SO_4, you benefit by recovering a valuable product—thus reducing your operating costs.

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- Technical data gathered from 22 years experience producing and supplying gas treating chemicals. These data can help you in construction of new facilities, the enlargement of present equipment and in securing trouble free performance of existing plants.
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- √ Constant improvement in design, materials and workmanship for half a century.
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Stop in today or call at your friendly CONTINENTAL or D+B store. Take advantage of our pump shop service. You'll find a complete stock of D+B Pumps, Parts and bulletins available.

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Distributor for . . .

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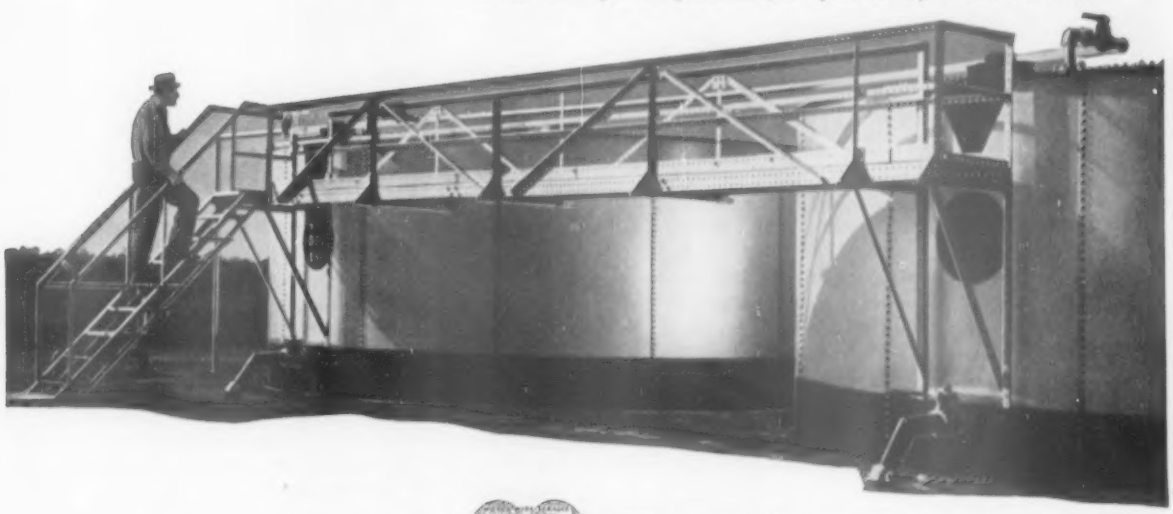
access to your bolted tanks with steel walkways and stairways

Complete your tank battery with easy-to-assemble Butler steel walkways and stairways and you'll be sure your personnel will work in safety, with greatest efficiency.

These firmly cross-braced walkways and stairways give years of service, require little maintenance, fit any A.P.I. bolted tank. Stair treads are roomy, and burr-punched for safety. Hand rails have rounded corners, easy to reach.

The next time you bring in a well, call your nearby Butler distributor.



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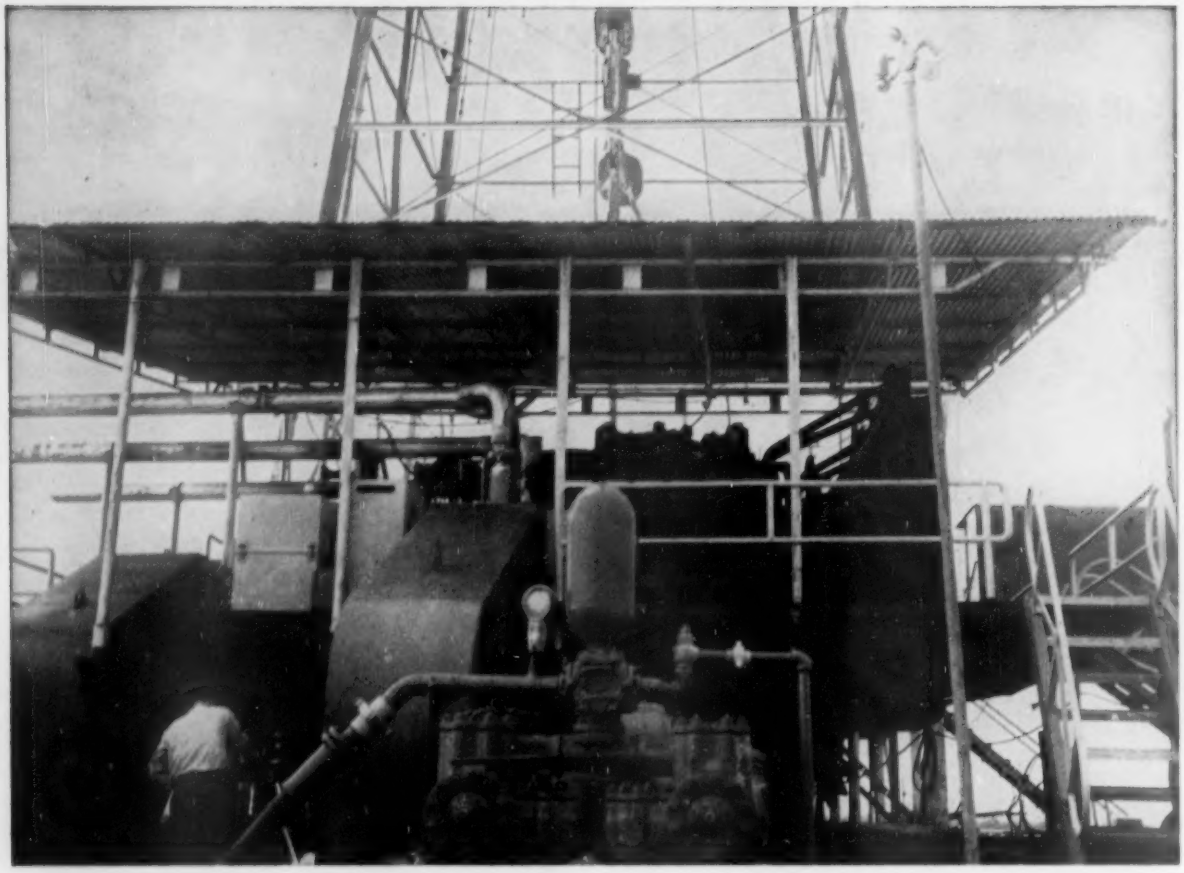


Deephole Drilling . . . In a Hurry !

. . . the acceleration, lugging power, and dependability you get from Le Roi L3460 and L4000 engines mean faster round trips and lower drilling costs.

WHEN you have to go deep you need plenty of horsepower. And the place to get it is from Le Roi's L3460 with 600 max. hp. or its big brother, the L4000 with 655 max. hp.

You get much more, too. You get compactness. These V-12 overhead-valve engines are only 164 in. long. That makes them ideal for drill-rig installation, because they pack a lot of power in a small space — give you more horsepower per dollar.

But that's not all you get from these high-output engines. They represent the first, truly new design concept in 15 years. They have improved fuel economy; integral crankcase and cylinder construction for greater rigidity; longer bearing life; hydraulic valve lifters; better manifolding; husky crankshaft with integrally forged counterweights for unbelievably smooth operation — modern features that mean lightning response to load demands, outstanding performance and dependability.

Like all Le Roi engines, they're built to stand oilfield handling; they're easy to service; they have a wide speed range up to 1350 rpm; and they operate on natural gas, butane, or gasoline.

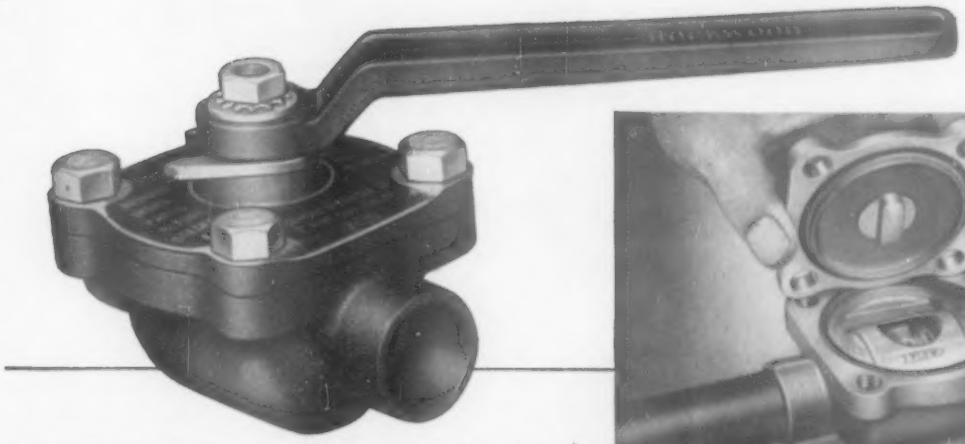
Ask your supply house or Le Roi distributor to show you an L3460 or L4000 at work. See for yourself why they can help you make hole faster. Literature is also available — just write us for it.

P-179

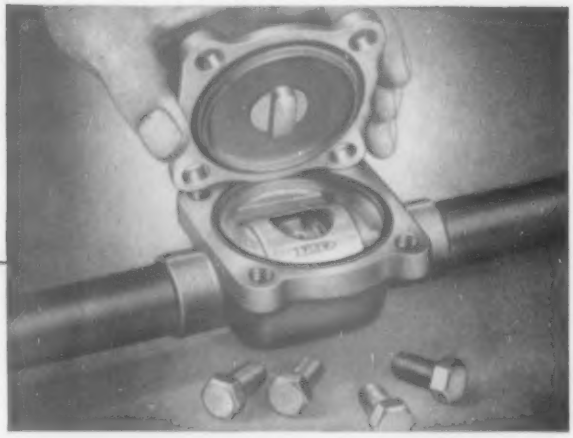
LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 1, Wisconsin

PORTABLE AIR COMPRESSORS · TRACTAIR · STATIONARY AIR COMPRESSORS · AIR TOOLS · ENGINES



FAST, LOW-COST CHANGE IN DIRECTION OF FLOW. Removal of the body cap permits reversing the cage assembly to allow change in direction of flow. In addition, this feature lets you change seat material, and clean the valves thoroughly and quickly — *without removing the valve from the line!*



INTERCHANGEABILITY of seat material to meet your operating requirements is another feature of the Rockwood Top Entry Ball Valve. Seat can be furnished in Buna-N, Neoprene, Kel-F, Teflon, and Nylon.

EASY INSTALLATION AND OPERATION is permitted because of the new handle design. This new design allows the handle to be placed in any of *eight positions!*

Now!... New Rockwood Top Entry Ball Valve

. . . A new concept in valves that saves you money and time!

Made of bronze the new Rockwood Top Entry Ball Valve is ideal for handling oxygen and hazardous liquids as well as water, oil and gas. It carries 300 lbs. per square inch on water, oil and gas and 400 lbs. per square inch on LP gas and is available both with sweat ends and screw ends, in sizes ½", ¾" and 1".

Write for complete data on this unique full round pipe size flow.

ROCKWOOD BALL VALVES

FULL, ROUND FLOW

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Title.....

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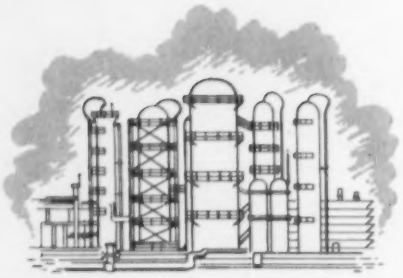

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The combination of durability, deep penetrating action and fast cutting speeds makes CP

Three Cone Rock Bits the favorite of drilling rig operators everywhere. Available in seven different types, there's a CP bit for every kind of formation from soft to exceedingly hard and abrasive. For more details write Oil Tool Division, Chicago Pneumatic Tool Company, 5000 U.S. Highway 81 So., Fort Worth, Texas.

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ON HANDLING TOUGH CORROSIVES!

USE **CHIKSAN**

LOADING ARMS

To maintain smooth production schedules, Eastman Kodak brings corrosive solvents and acids to its Rochester plant via truck from nearby tank farm storage. Corrosive action, however, was destroying loading hoses after comparatively short periods of use. To overcome this costly problem Kodak replaced its hoses with Chiksan Loading Arms. That was 10 years ago. Today, there are over 40 Chiksan Loading Arms in service at Kodak Park and not one record of product fatigue to date.

Whatever your fluid handling requirements, be it corrosive or other, insist on Chiksan Loading Arms—the time proven answer where the accent is on service, safety and speed.

There's a Chiksan Catalog waiting for you. Send for it today.

FOR CATALOG, WRITE DEPARTMENT 3-6

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Buildings "tailor-made" to your needs at a "ready-made" savings

Attractive, durable warehouses, offices, pumping stations or other buildings can be yours at low cost. Armco Steel Buildings give you the economy of standardized construction plus a wide range of sizes to meet your building needs.

Armco Buildings go up in hours and require little or no maintenance. They are sturdy and weathertight. For future expansion they can easily be extended with standard parts. Interiors can be unfinished. Or, if desired, you can insulate and finish the interior according to your needs.

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Clear-span widths allow full use of interior space.

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Variety of sizes and layouts fit the building to your needs.

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Interiors can be plain or as elaborate as desired.

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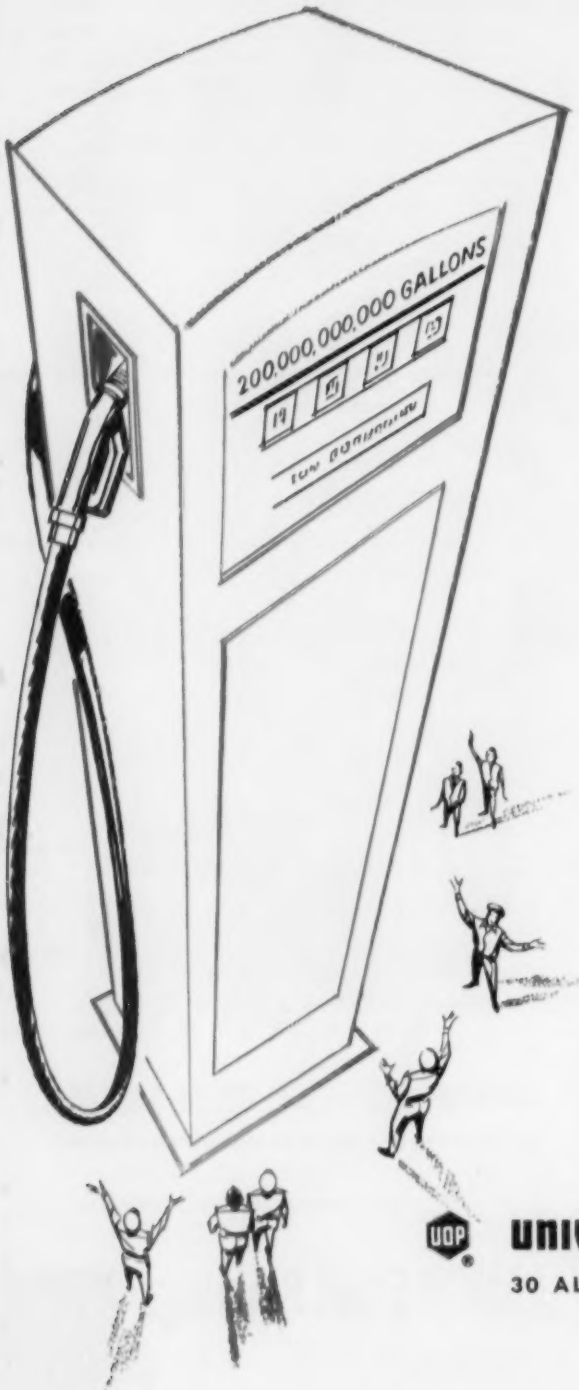
OF GASOLINE KEPT GUM-FREE WITH UOP #5 INHIBITOR



Any way you figure it, that's a lot of gasoline . . . convincing proof that the petroleum industry has approved and demanded UOP #5 Inhibitor.

Obviously, there are good, sound reasons for this preference. UOP #5 has demonstrated unexcelled inhibitor potency and versatility. It is the product you can depend on for the really tough stability jobs.

UOP #5 is economical. For any given stability requirement you can't beat #5 on a cents (or fraction thereof) per barrel basis. Remember, five molecules of UOP #5 will protect 1,000,000 molecules of gasoline.

UOP Inhibitor #5 was introduced by Universal during World War II and the techniques of applying it have been effectively developed over the years. This experience is offered to refiners, and our on-the-spot representative will be glad to assist in its application to your products. Just write us.

PRODUCTS DEPARTMENT

UNIVERSAL OIL PRODUCTS COMPANY

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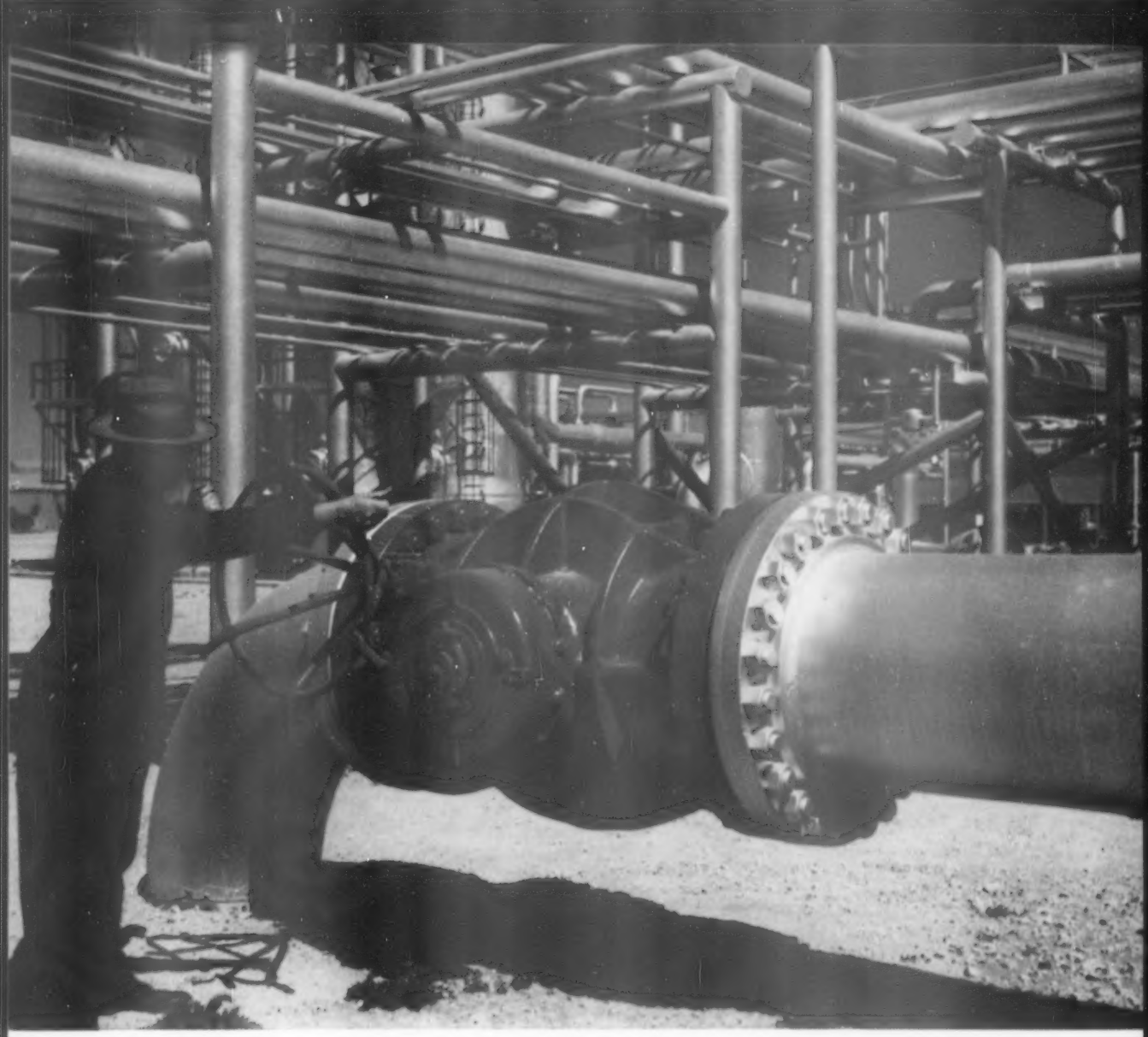


How much does a valve cost?

A valve that fails in an emergency can cost millions of dollars in equipment and product loss. In any key spot, Rockwell-Nordstrom lubricated plug valves are your best insurance against this kind of loss. They operate instantly; they shut off positively; and they *stay* efficient. These are facts you can depend on—they have been *proven* through 40 years of outstanding performance.

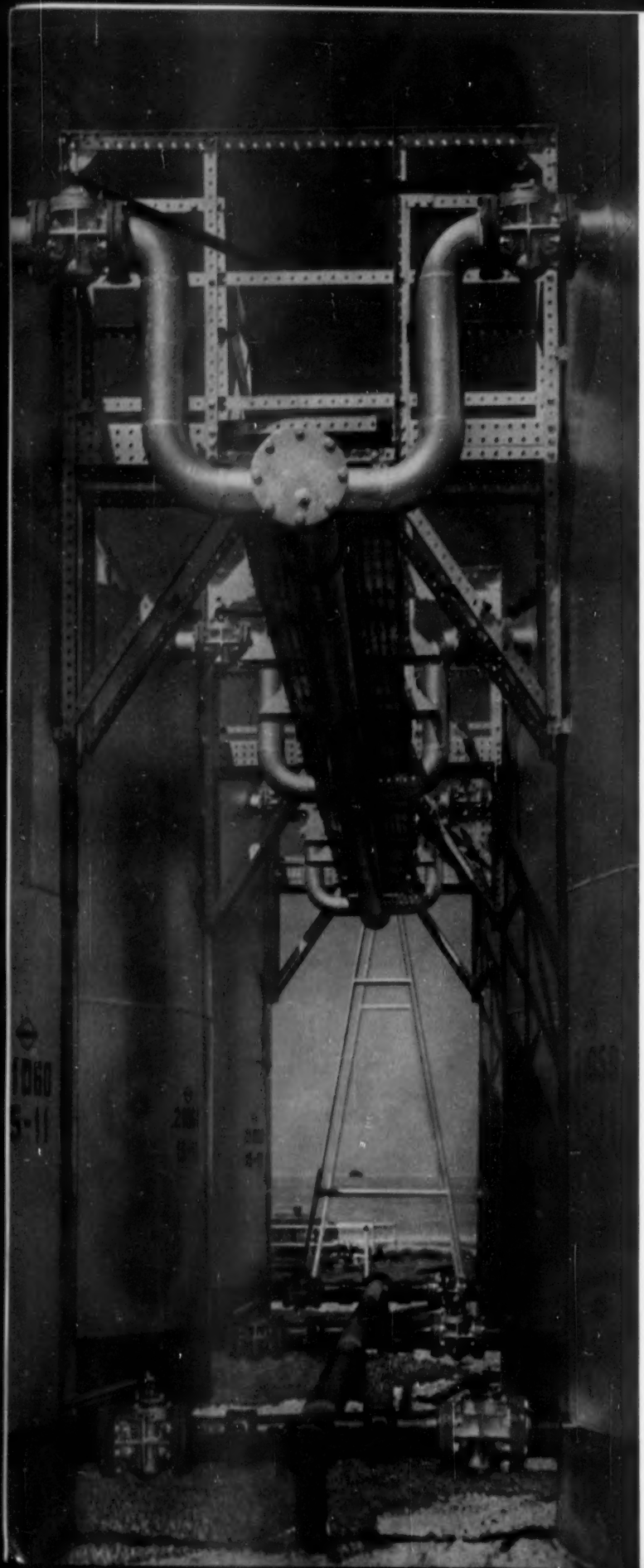
Rockwell-Nordstrom valves are available in a complete range of sizes and pressure ratings. They cost no more to buy, often less, than ordinary valves . . . and their dependability cannot be matched by any valve at any price. For more information, write: Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.

Available at leading suppliers . . . everywhere.

ROCKWELL-Nordstrom **VALVES**

Lubricant Sealed for Positive Shut-off

40th Year *of lubricated plug valve leadership*



Liquid flow control... at its best

Rockwell-Nordstrom valves' proven dependability and economy keep costs down on *any* liquid service. Pressurized lubricant sealing for really positive shut-off, plus smooth quarter-turn operation, assures precise flow control on complex manifolds or remote pipe line valves. Because Rockwell-Nordstrom lubricants eliminate metal-to-metal friction, trouble doesn't have a chance to start. This means that yearly cost is much lower than ordinary valves. Original cost is no more, and often less.

Rockwell-Nordstrom, the original and most complete line of lubricated plug valves, are available in steel, semi-steel, stainless steel and special alloys for a complete range of pressures and temperatures. For more information write: Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.

Available at leading suppliers . . . everywhere.

ROCKWELL-
Nordstrom
VALVES

Lubricant Sealed for Positive Shut-off

40th Year
of lubricated plug valve leadership

AXELSON PICTORIAL

SATISFIED CUSTOMER. Tad Travers (left) President of Brookline Oil Company, Los Angeles, shown with Don Moses, Axelson representative from Long Beach, who delivered the pump to Petrolia, California, 700 miles away. Travers says, "Axelson got us out of a bind. That's one outfit you can always depend on."

DRIVES 700 MILES TO DELIVER A PUMP

At Petrolia, California, (about 50 miles south of Eureka on the coast) the Brookline Oil Company had a well down. It was during a 3-day Labor Day holiday and no one could get a pump to them until after the week-end. In desperation, Tad Travers, President of Brookline, called Axelson in Los Angeles and told them the problem. The type of pump needed was located in the Long Beach store.

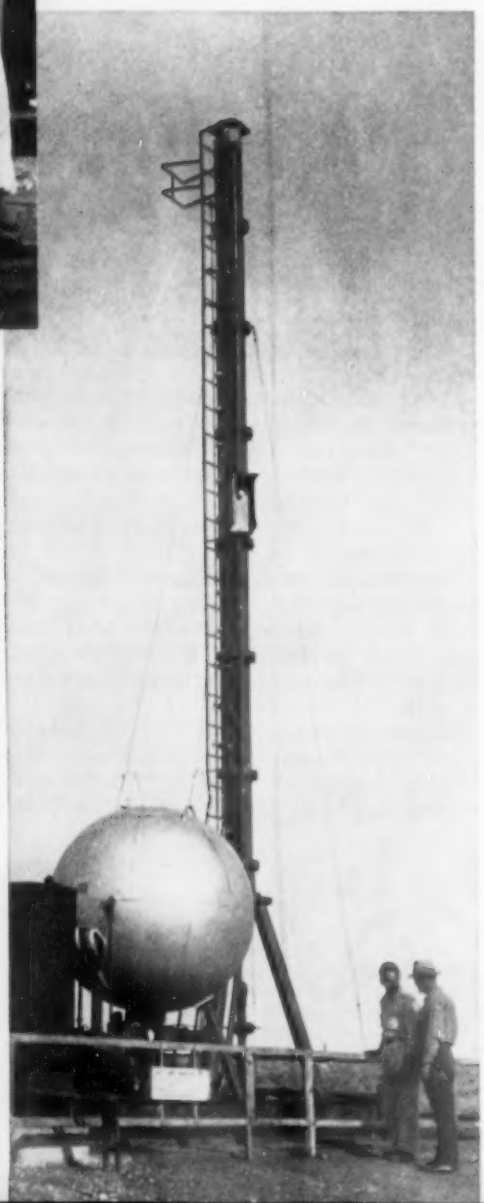
There was no way of getting it to the well by any available means of transportation. It was too big to go on a plane. So Don Moses, Axelson representative from Long Beach, strapped the pump to his car and took off for the location over 700 miles away. Driving non-stop, he arived just as the pump was coming out of the hole.

Travers was so glad to see Don pull up at the well site with the new pump that he cooked him a barbecue. "Axelson is one outfit you can always depend on," Travers says. "As far as our company is concerned, Axelson has no competitors."

FRESH PUMP DELIVERY. The route taken by Don Moses on his non-stop journey from Long Beach to Petrolia. The first oilwell in California was drilled in Petrolia by Leland Stanford in 1864. Roads were so bad that well drilling equipment was shipped in by water. The oil (48 gravity) was called "rock oil" and was used for medicinal purposes. It was carried out in demijohns slung to the backs of mules.

A MILLION BARRELS. This is one of 4 wells on the Ralph E. Fair lease in Talco, East Texas. All are equipped with Axelson subsurface pumps and sucker rods. These wells have been pumping for 18 years and have lifted over a million barrels of oil *without once being pulled*. Checking the Batson #1 (46 B/D, 23 gravity, 4,150 ft.) are Willie Buchaman, Pumper (left) and Omer Cole, Lease Superintendent.

DEEP STUFF. At six strokes per minute, this Axelson Hydraulic Long Stroke pumping unit lifts 100 B/D of 48 gravity crude oil *from a depth of 11,500 ft.* (Well No. 1, R. K. Cone Lease, Warren Petroleum and Jake L. Hamon, Lea County, New Mexico). Checking the performance is T. C. "Ted" Tilgham, Pumper, (left) and Sandy Brock, Axelson Representative working out of Hobbs, New Mexico.



AXELSON

FIRST OFFSHORE. Drilled in 1864 by an Italian at El Salto, Peru, this well is believed to be the first offshore well in the world. Now the property of Empresa Petrolera Fiscal, it is still pumping. Axelson sucker rods are in service in this well and elsewhere in the field. Gross Equipment, S. A. is the Axelson distributor in Peru.

400 PUMPS. Lee Nave, Axelson Area Manager, sent in this picture of Axelson's pump repair crew at Lagunillas, Venezuela, in the middle of the Lake Maracaibo oilfields. He writes, "This crew was averaging 400 pumps a month at the time this picture was taken."

AXELSON PICTORIAL

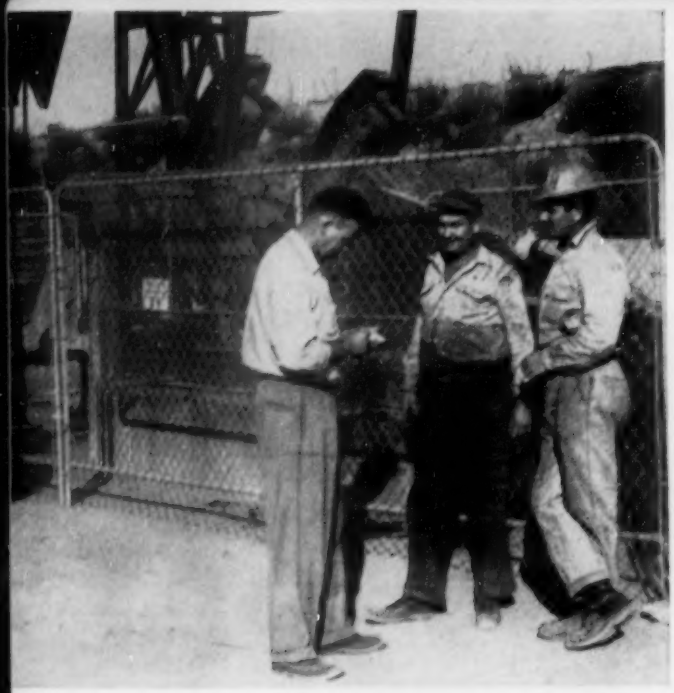
HAPPY HUNTING. Last Fall, a group of oil men left Taft, California, for Utah where they bagged this 6-point buck (32¾" spread). It was the biggest deer reported in southwest Utah in '55. Left to right (standing): Red East, Standard Oil Company of California; George Napoleon, Socal; Harry Easton, M. H. Whittier Co.; (kneeling Gerald Parcel, Socal; Rod Napoleon (who shot the buck), Socal; Red Carroll, General Petroleum Corp.

BOOSTER. Taking inventory of the new gas booster installed by the Continental Oil Company in the Short Junction Field, is Harold Smith (left), Maintenance Engineer and Guy Lane from the Accounting Department at Ponca City, Oklahoma. This field is in Cleveland County about 15 miles southwest of Oklahoma City and is the hot spot in Oklahoma at the present. Continental Oil, a good customer for Axelson rods and pumps, has 65 wells producing from the Hunton Lime at 8,000' to 8,082'.

39 WELLS. Forest Oil Corporation has 39 wells in the East Goldsmith Field, Ector County, Texas, equipped with Axelson rods and pumps. Most are pumping from the Pennsylvania at 8,600', the rest are Holt production at 5,000'. A few flowing wells are scheduled to go on pump later in the year and Axelson rods and pumps have been specified. (Left to right) M. W. Johnson, Pumper; S. J. Ingram Jr., Space Hopper; S. J. Ingram Sr., Production Foreman; Gene T. Ingram, Door Slammer.

100%. Standing beside the T. M. Armstrong #24 at Gladewater, Texas, is Lloyd Stevens (left) Pumper, and O. B. Moon, Farm Boss. From the polished rod to pump shoe, this well is Axelson equipped: Axelson Kup-Pak pump (2½"x2"x12'), ¾" #60 Axelson Sucker Rod (3,600'), Axelson #60 (1¼"x11') polished rod, Axelson Stuffing Box, Mario Packing. This packing has been running over 18 months without requiring replacement.

AXELSON PICTORIAL



TWO DOGS LONG. This is Consolidated Production Company's B-9 at Long Beach, California. An Axelson RLA top-lock pump, 2½"x1¾"x12', was installed November 26, 1941 *and has never been pulled.* It pumps low gravity crude oil (14.5) from the Ranger Zone at 2,550 feet. Axelson rods and stuffing box are also on the job. Talking shop (from left to right): Walt Lauerman, Lease Foreman; Gene Cook, Roustabout; Al White, Truckdriver. Walt says, "Ours is probably the longest and narrowest lease in the world. We call it "the Dachshund"—two dogs long and half a dog high."

18 CENT OIL. In 1933, Oklahoma operators objected to the proration laws of the state and forced the price of crude oil down to 18 cents a barrel. Governor William "Alfalfa Bill" Murray called out the National Guard and shut down 3,108 wells in a move to raise the price. When oil rose to 85 cents, the governor called off his militia. During these black days, the price dropped to 6 cents a barrel in East Texas. Photo (courtesy of Oil & Gas Journal) shows "Murray's Army" standing watch over wells in South Oklahoma City Field. Axelson pumps and rods have been producing Oklahoma City fields since oil was discovered there in 1928.

SINCE 1905. This J & L store opened in Bartlesville, Oklahoma, over 50 years ago and is the oldest oil supply location west of the Mississippi. It is part of a network of 91 J & L stores in the U. S. and Canada, selling and servicing Axelson equipment.

No. 4

Specify **AXELSON** *for*
Subsurface Pumps
Sucker Rods
Hydraulic Pumping Units
Stuffing Boxes & Packing
for better production

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Where to buy Axelson Production Equipment:

CALIFORNIA: *Axelson stores at Bakersfield, Coalinga, Huntington Beach, Long Beach, Orcutt, Santa Fe Springs, Taft, Ventura; Hickey Pipe & Supply Co. (Sucker Rods)* • **MID-CONTINENT:** *Jones & Laughlin Steel Corporation, Supply Division (Headquarters, Tulsa)* • **PERMIAN BASIN:** *Axelson Warehouse, Odessa (Hydraulic Pumping Units only).* • **ROCKY MOUNTAINS:** *Jones & Laughlin Steel Corporation, Supply Division; Great Northern Tool & Supply Co., Billings, Montana* • **CANADA:** *Jones & Laughlin Steel Sales Co. Ltd., Calgary; Dominion Oilfield Supply Co. Ltd., Calgary* • **MEXICO, D. F.:** *Wells Fargo & Co. Express, S. A.* • **RIO DE JANEIRO, BRAZIL:** *MAQUIP (Commercial de Maquinas e Equipamentos) S. A.* • **LIMA, PERU:** *Gross Equipment, S. A.* • **LA PAZ, BOLIVIA:** *Del Prado & Compania, Ltd.* • **BUENOS AIRES, ARGENTINA:** *Adrian Bolland & Cia., S. R. L.* • **BARCELONA, VENEZUELA** • **MARACAIBO, VENEZUELA** • **TRINIDAD, B. W. I.:** *Industrial Agencies, Ltd.*

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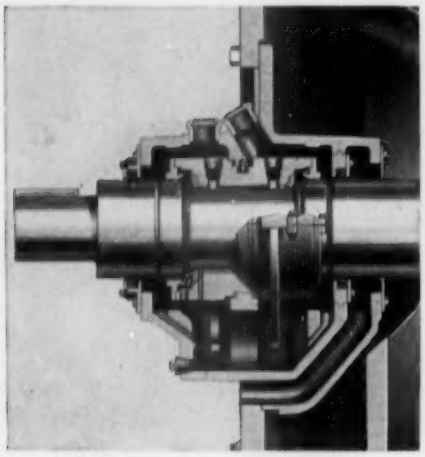
For more than 20 years, more scheduled revenue airline miles in the U. S. have been flown with Texaco Aircraft Engine Oil than with all other brands combined.

The Texas Company

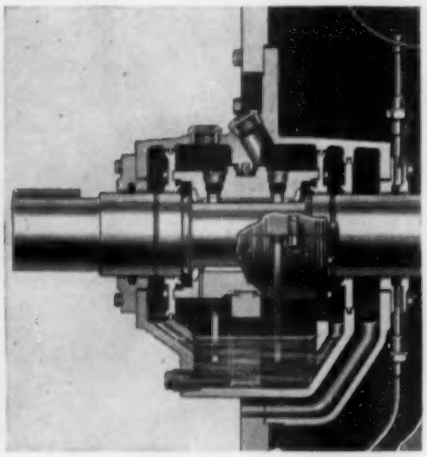
TEXACO

NEW Bearing Design Means Better Motor Performance

Allis-Chalmers capsule-type sleeve bearings now perfected for complete motor line



Standard capsule-type sleeve bearing



High speed capsule-type sleeve bearing

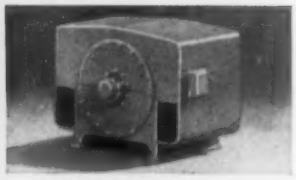
A new feature—an improved capsule-type bearing design—has been added to the Allis-Chalmers complete line of large end-shield bearing motors. This new bearing will give you better motor service, simplified maintenance and longer motor life through features like:

- Dust-tight, leakproof enclosure protects bearing from dirt, dust or abrasive materials.
- Venting system prevents oil leakage — keeps oil and vapor from getting into motor enclosure.
- Dual oil-rings insure bearing surface lubrication — either ring can adequately lubricate bearing.
- Split end-shield gives easy accessibility to winding and air gap — without disturbing capsule or bearing alignment.

Drip-proof or splash-proof cage motor

Synchronous or wound-rotor motor

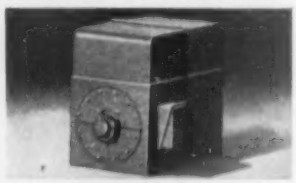
High speed cage motor



Weather-protected motor

Totally-enclosed fan-cooled motor

Totally-enclosed forced-ventilated motor



Water-cooled or inert-gas-filled motor

Capsule-type bearings are standard on these Allis-Chalmers motors.

You get MORE from Allis-Chalmers motors

More design and construction features — more application help. For complete information, contact your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5032

for Deeper, Safer Drilling— New VHS Drilling Lines

• In Louisiana, West Texas, the Williston Basin, the Gulf of Mexico —drillers everywhere are demanding the advantages offered by rotary drilling lines of new LAY-SET VHS. For new VHS lines are 15% stronger than those made of Improved Plow Steel—the strongest grade available before the introduction of VHS.

HIGHER SAFETY FACTOR

Obviously this means a higher safety factor. For example, 10 lines of VHS have a safety factor about equivalent to 12 lines of Improved Plow Steel. Or, with 10 lines of VHS you get a safety factor 14.9% or 15% higher than with 10 lines of IPS.

SAVE TIME!

With stronger VHS you can drill deeper before increasing the number of parts of line. You can make round trips faster. And the extra strength of VHS eliminates in many cases any necessity for buying new blocks or regrooving sheaves to use larger diameter lines for higher safety factor.

TOUGHER, TOO!

In addition to its greater strength VHS is tougher. It has greater resistance to abrasion and higher resistance to peening—both important factors in maintaining shape and diameter. Following regular, adaptable cut-off practices should result in ton-mile advantages.

IN STOCK NOW

Call your Hazard distributor for LAY-SET VHS drilling lines in the length and diameter you need. He probably has them in stock—or he can get them fast. You don't need any complicated specifications.

for further information write to the nearest Hazard office for Brochure DH-522

LAY-SET VHS

15% Stronger • Tougher •

HAZARD WIRE ROPE DIVISION
American Chain & Cable Company, Inc.

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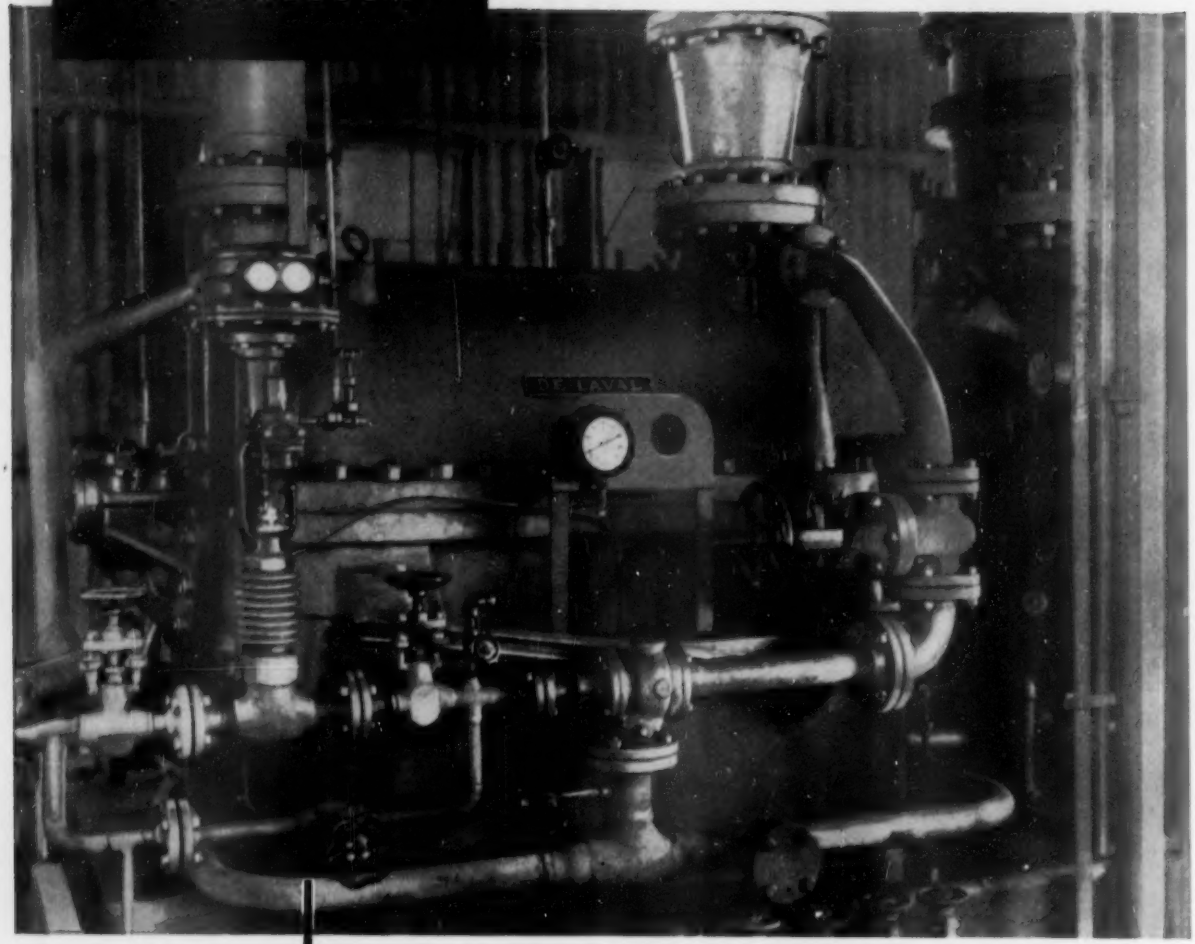
Wilkes-Barre, Pa.; Odessa, Texas; New York, N. Y.; Philadelphia, Pa.; San Francisco, Calif.

DE LAVAL
CENTRIFUGAL COMPRESSOR

handles hydrocarbon gas in Sunray Oil refinery



Send for new Bulletin 0504

This De Laval 7-stage centrifugal gas compressor, installed at the Duncan, Oklahoma refinery of the Sunray Oil Company, handles a heavy hydrocarbon gas in a delayed coking process. The gas has a molecular weight of 31.5.

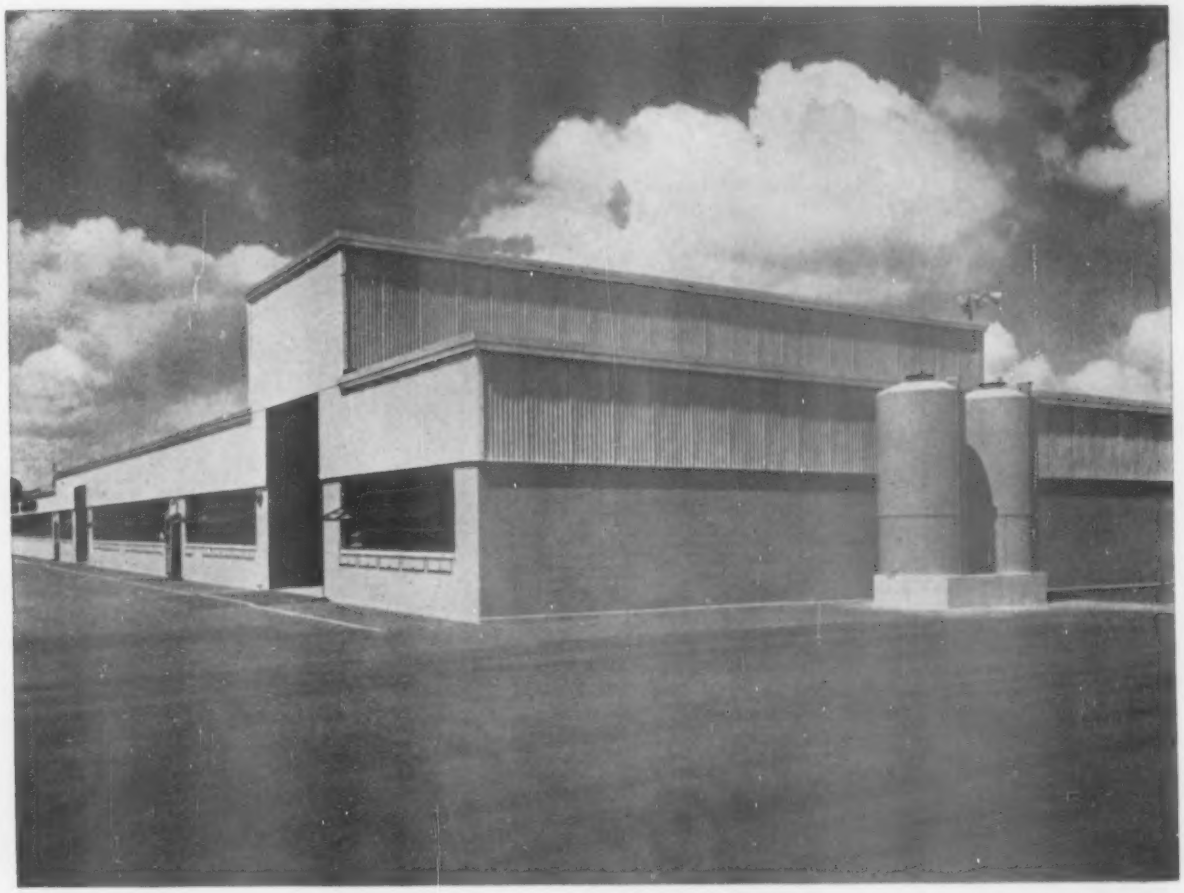
The De Laval centrifugal compressor is rated at 2840 inlet cfm; discharge pressure is 240 psia. The power required is 1350 bhp with compressor operating at 9900 rpm.

Sunray Oil is another refinery which has selected De Laval compressors for heavy-duty continuous service. Rugged, horizontally split casings, individually designed impellers, perfectly balanced rotors and externally mounted, cylindrically seated bearings are design features that assure optimum performance and long service.

DE LAVAL *Centrifugal Blowers*

DE LAVAL STEAM TURBINE COMPANY
810 Nottingham Way, Trenton 2, New Jersey

DL 327



K&M Corrugated Asbestos Sheets, used as siding on the Operations Center of a southeastern utility company, complement the clean, modern lines of the building. These sheets are also used on a pitched roof, not shown in the photograph. Engineering and supervision of construction: Stone and Webster Engineering Corporation. Applicator: Whatley Roofing and Sheet Metal Works, Tampa, Florida.

Attractive, weather-proof, fire-proof, maintenance-free
K&M Corrugated Asbestos

Building a new plant? Modernizing your present one? In either case, you'll gain important cost and other advantages with K&M Corrugated Asbestos-Cement Sheets. They cannot burn, can't rot or corrode—withstand the ravages of time and weather year after year. Because K&M Corrugated Asbestos-Cement Sheets rarely require maintenance, *never* need protective painting, their upkeep is held to the barest minimum.

Easy to apply. These corrugated sheets offer big savings in application costs. They go on quickly, are easily sawed, drilled, and fitted on the job.

Write for complete details on K&M Corrugated Asbestos Roofing and Siding.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos

Here's How

REPUBLIC ALLOY STEELS

can help you in the race against time and mounting costs

Maybe you're pushing to get a new rig operating. Or, perhaps your problem is keeping equipment going at maximum efficiency and at lowest possible cost. Whatever the case, Republic Alloy Steels can help you just as they have thousands of others in tough oil country jobs from Texas to Canada.

These fine steels provide dependable, economical, day-in day-out service on the surface or four miles down. That's why they are used for gears, shafts and bearings in draw works—and for drill bits, tool joints, slips, tongs, kellys, blocks, pumps and chain.

Alloy steels are particularly important in today's deep drilling operations. Their exceptionally high strength-to-weight ratio permits the use of lighter equipment and smaller sections without sacrifice of safety. This reduction in dead weight of working parts means greater efficiency and economy in operation.

Alloy steels are unusually tough and strong. They can absorb sudden shock and impact with-

REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

out failure. They resist fatigue and corrosion. They perform safely in high temperatures or sub-zero cold. They resist wear and abrasion.

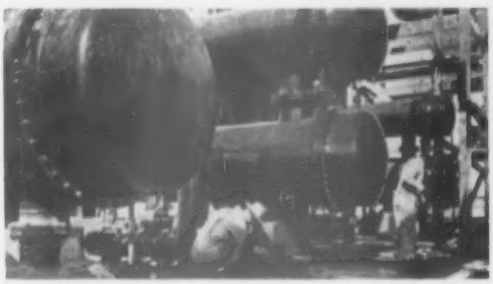
If you are interested in reducing downtime for maintenance, in cutting repair and replacement costs, then you'll want to know more about Republic Alloy Steels. Our metallurgists will give you prompt assistance in applying these cost-cutting steels to your specific requirements. There's no obligation, so mail the coupon today.

STEEL

and Steel Products

More Republic Products to Speed Your Job and Cut Costs

ALLOY STEEL STUDS AND HIGH CARBON HEX NUTS help lick the three common causes of stud failure—high pressures, high temperatures and corrosion. Republic-made alloy steels provide toughness and strength under temperature extremes. Clean accurate threads provide maximum holding power, resistance to wear, easy tightening, trouble-free back-off for equipment maintenance. Specify Republic on your next order from your distributor.



REPUBLIC ELECTRUNITE HEAT EXCHANGER TUBES are doing an outstanding job in many leading refineries. One of the big reasons is ELECTRUNITE uniformity. That means uniform wall thickness, without longitudinal thin spots. Uniform diameter, which means tubes slide easily and quickly through holes in drums and headers. Uniform expansion means less danger of over- or under-rolling. Installation costs are lower, too. Available in carbon or stainless analyses.

ENDURO STAINLESS STEEL REFINERY EQUIPMENT resists the effects of heat and pressure. Discourages coking and fouling. Stays on stream. Safeguards your refinery investment. ENDURO equipment is solid stainless steel. There's no applied surface to crack, flake or peel. It resists corrosion, stays easy to clean. It retains its high strength at both ends of the thermometer. Your equipment supplier has all the facts, or write us.

REPUBLIC STEEL CORPORATION
Dept. C-2057
3112 East 45th Street
Cleveland 27, Ohio

Please send more information on:
☐ Alloy Steels ☐ ENDURO® Stainless Steel
☐ ELECTRUNITE® Heat Exchanger Tubes ☐ Alloy Studs
☐ Have an Alloy Metallurgist call

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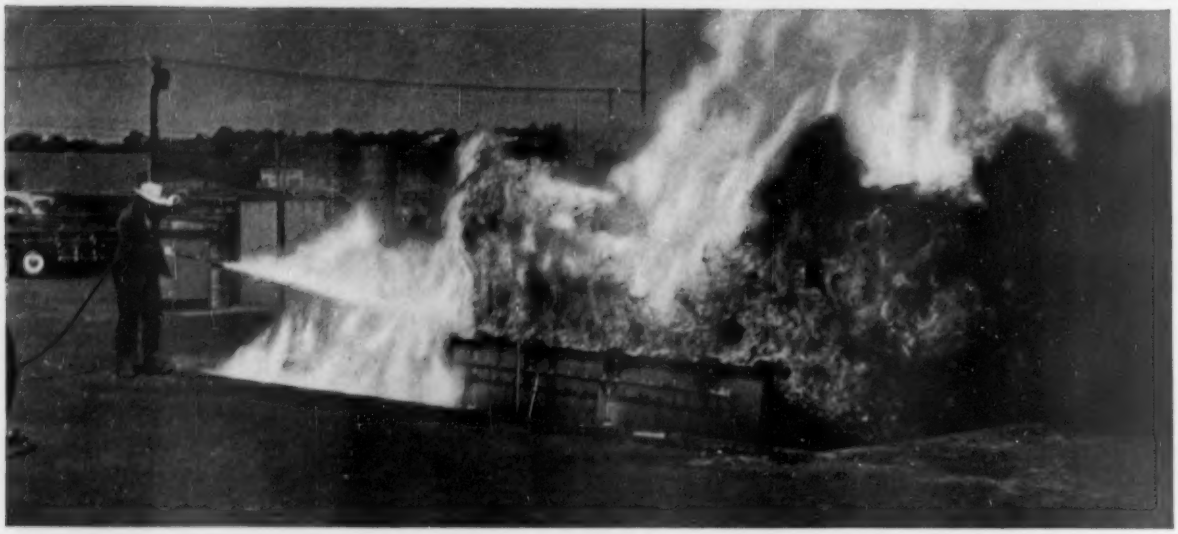
Company_____

Address_____

City_____ Zone_____ State_____

SUDDEN DEATH TO OIL FIRES!



Kidde wheeled units make short work of any blaze!

"One-man fire engines" are what some people call Kidde mobile fire extinguishing units . . . and with good reason! With one or two Kidde mobile units near large-scale fire hazards, there's no waiting fretfully for the fire department when fire strikes . . . you *are* the fire department!

Especially effective in fighting fires in oil, gasoline or other flammable liquids, Kidde *dry chemical* wheeled units have an on-off control *at the nozzle* (for easier operation) will give either "straight" or "fan" pattern for greater range or wider coverage. Designed for fast, easy maneuvering, Kidde *indoor* dry chemical "fire engines" pass readily through doorways with no costly waste motion, while *outdoor* models have wider-faced wheels for faster action on soft ground surfaces.

Kidde mobile fire extinguishing units are also available in CO_2 and foam types – illustrated and described below. For more information, call your nearest Kidde agent (he's in the yellow pages) or write today for Kidde's P-8 catalog.

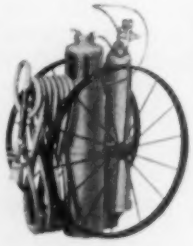
40-GALLON FOAM UNITS

Ideal protection against flammable liquid fires, delivering more than ten times its tank capacity in fire-smothering foam. 50 feet of hose, 50-60 foot effective range.

CO_2 WHEELED UNITS

Available in 50, 75 and 100-pound single-cylinder capacities. Shut-off valve located at nozzle gives operator complete control. Especially good indoors since CO_2 gas leaves no mess to clean up after a fire.

150-POUND DRY CHEMICAL UNITS

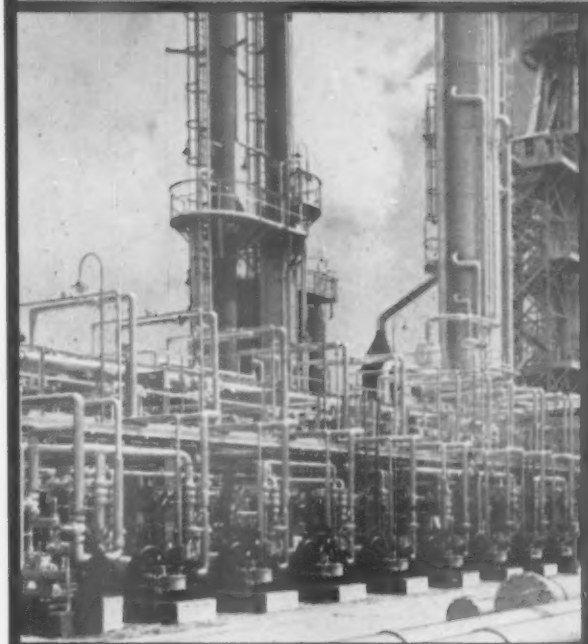


Single-lever control for "on," "off," "fan" or "straight" discharge pattern. 30-40 foot range on straight discharge. 50 feet of hose. Easily handled by inexperienced operator.

Kidde Walter Kidde & Company, Inc., 654 Main Street, Belleville 9, N. J.

Walter Kidde & Company of Canada, Ltd., Montreal—Toronto

Which Steam Turbine For Your Job?



(Above) Seventy-five Elliott turbines, sized from 8 to 224 hp, drive pumps and fans throughout this Southwestern refinery.

(Below) Two Elliott 2100-hp, 4450-rpm, multistage single-valve turbines driving lean oil pumps in a new gasoline plant in Texas. Turbines have variable-speed governors and uncontrolled extraction.

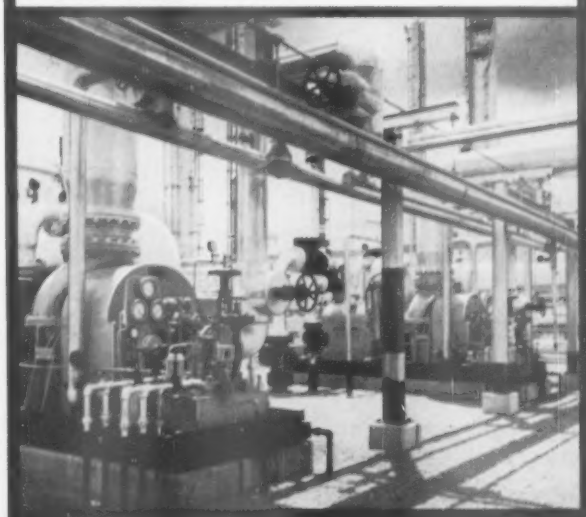
ELLIOTT TURBINES, from the smallest single-stage, to large multistage types, are busy serving refineries everywhere — standard single-stage turbines for most jobs, multistage turbines for larger sizes where economy is important, the JR for small sizes.

Your local Elliott Field Engineer can help you pick the type for your job. Check with him or write Elliott Company, Steam Turbine Division, Jeannette, Pa.

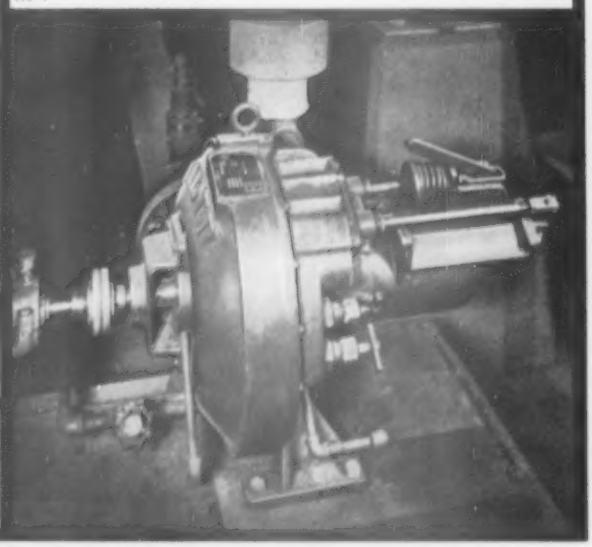
ELLIOTT Company

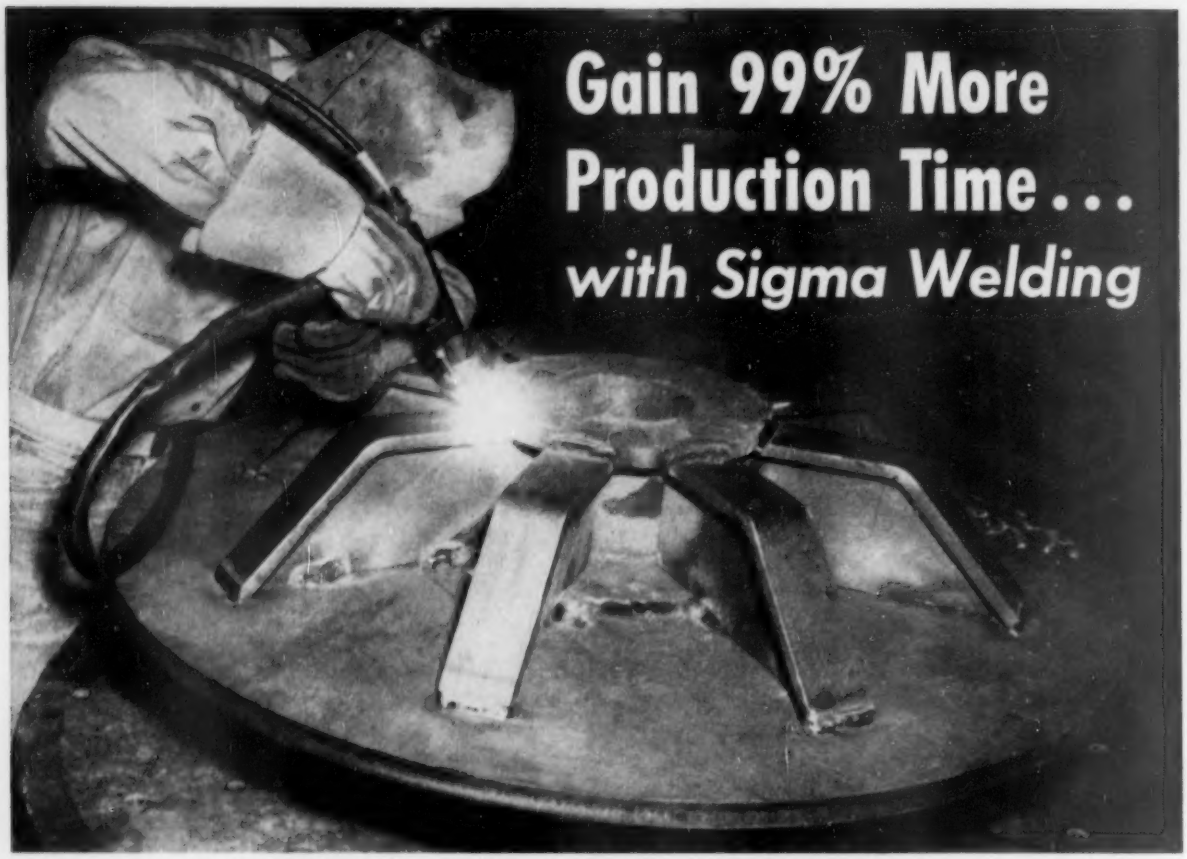
STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS
CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

H6-1



Close-up of the rugged and reliable Elliott Type JR turbine driving a small pump. Sturdy design and minimum first cost make this a popular choice for low hp requirements (up to 45 hp, 4000 rpm).





Steel gussets, $\frac{5}{8}$-in. thick are sigma welded to $\frac{7}{8}$-in. thick drum ends at an average speed of 15-in. per minute.

This welding operator doesn't have to bother with fluxes—and he doesn't lose valuable time changing burned down electrodes. In fact, by using sigma welding in this operation, the Cardwell Manufacturing Company, Wichita, Kansas has increased welding speed and almost doubled arc time. The results—a better product, faster, and at less cost.

AUTOMATIC WIRE FEED

Sigma welding uses a welding wire, supplied from a convenient sized coil, as a consumable electrode. In this case it is stainless steel wire which is fed automatically, and at a predetermined rate, into the welding arc. This ups welding speeds and simplifies work.

NO FLUX

The arc is maintained in a shield of argon gas which envelopes the area between welding wire and work piece. Inert gas protection assures highest weld quality, and further simplifies welding operations.

Sigma welding is available in both manual and mechanized setups. Call or write your local LINDE representative for free illustrated literature, and find out how you can gain new production speed and unit quality with a sigma welding installation.

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A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
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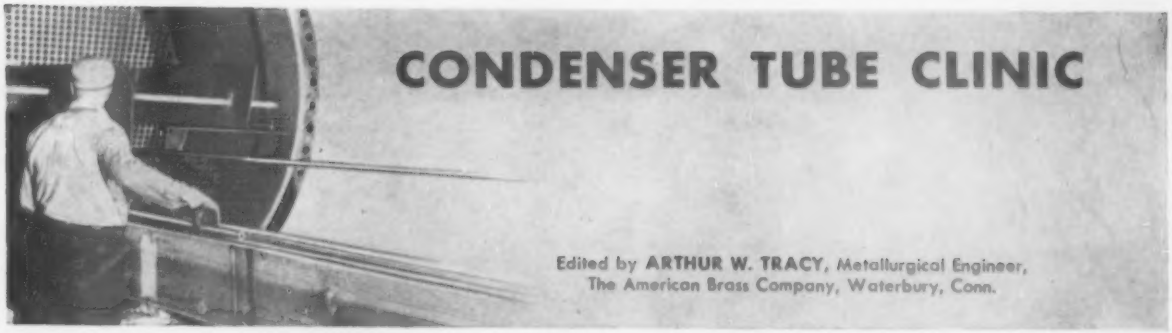


CONDENSER TUBE CLINIC

Edited by **ARTHUR W. TRACY**, Metallurgical Engineer,
The American Brass Company, Waterbury, Conn.

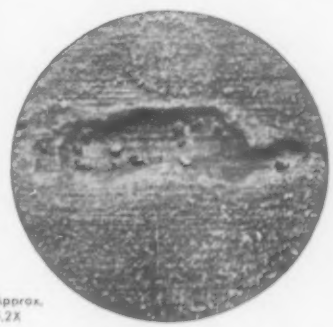
Choose the right alloy for your condenser tubes

LONG condenser tube life depends on the proper choice of alloy as well as conditions of operation.

Fresh inland cooling water normally does not cause corrosion problems; either ANACONDA Arsenical Admiralty-439 or ANACONDA Phosphorized Arsenical Copper-108 tubes will give long service. ANACONDA Ambronze-421 tubes have been found more durable for river waters polluted with acid coal-mine drainage.

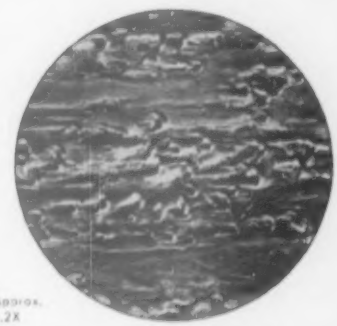
Sea water is usually more corrosive than fresh water. Clean sea water flowing turbulently, especially when air bubbles are present, causes inlet-end impingement pitting. Lowering the velocity, with subsequent smoother water flow, will solve this problem; but such a solution is not always economically feasible. ANACONDA Ambraloy-927 tubes are definitely more resistant to impingement corrosion than are admiralty metal tubes. Where water velocities are relatively high, ANACONDA Cupro Nickel, 10%-755 tubes can be expected to give even better service. ANACONDA Cupro Nickel, 30%-702 tubes are considered for the highest water velocities normally encountered in exhaust condensers.

Sea water in harbors and at river inlets is often polluted with decomposing organic matter which may settle in condenser tubes and cause deposit pitting. Hydrogen sulfide, a product of the decomposition, is also an important factor in corrosion by polluted waters because poorly protective scales containing metallic sulfides are formed. Chlorinating polluted waters is helpful in preventing deposit attack. Frequent removal of debris by brushing is an important factor in increasing tube life. Ambraloy-927 tubes generally give long service handling polluted sea water. In some cases, either Cupro Nickel, 10%-755 or Cupro Nickel, 30%-702 have served best because they are more resistant to deposit pitting.



Approx. 5.2X

DEPOSIT PITTING in uninhibited Admiralty Metal tube from a tidewater power station condenser. In this case a deposit of paper pulp is believed to have shielded a small area, forming an oxygen-concentration cell. The shielded area—low in oxygen content—is anodic and corrodes. Surrounding areas in contact with the solution high in oxygen form the cathode. Since the potential between the two areas is quite small, deposit pitting is usually a slow process.



Approx. 3.2X

IMPINGEMENT PITTING in an Admiralty Metal tube from the main condenser of an oil tanker. Excessively high water velocity caused turbulence, which carries away metal ions so that a protective film cannot form. An ion-concentration cell is formed, with the low-ion impinged area anodic; the areas where streamline, undisturbed flow persists, being cathodic. Air bubbles, water velocity, hydrostatic pressure drops in the tube, and alloy content, are all factors in this problem.

Some ANACONDA Condenser Tube alloys especially resistant to pitting, and their nominal compositions

	Arsenical Admiralty -439	Ambraloy -927	Ambronze -421	Cupro Nickel, 10%-755	Cupro Nickel, 30%-702
Copper, %	71	77	88	88.35	68.90
Nickel, %	—	—	—	10	30
Zinc, %	27.96	20.96	10	—	—
Aluminum, %	—	2	—	—	—
Tin, %	1	—	2	—	—
Arsenic, %	0.04	0.04	—	—	—
Iron, %	—	—	—	1.25	0.50
Manganese, %	—	—	—	0.40	0.60

TECHNICAL ASSISTANCE—Your tube problem may require special consideration and analysis. We are always ready to help with such problems and advise in the selection of the right alloy to give the best service. Write for the new edition of our Publication B-2 on "Anaconda Tubes and Plates for Condensers and Heat Exchangers." The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5677

ANACONDA®
Tubes and Plates for Condensers and Heat Exchangers

Visibility unlimited . . .

DOW

Airplane patrol of pipelines calls for vegetation control with Dow products.

DOW WEED KILLERS SIMPLIFY AIR PATROL *and* MAINTENANCE

Keep vital oil areas vegetation free. The very best vegetation control at the very lowest cost—that's what you're looking for. And that's what you get with Dow weed, brush and grass killers. These products help you keep both your vegetation control problems and your costs under control.

When you keep vegetation from growing over and around pipelines, you simplify both airplane patrol and ground crew maintenance of these essential oil arteries. Where fire prevention is vital—you can depend on specific Dow chemicals doing specific jobs to clear and maintain extensive areas at a measurable saving per acre.

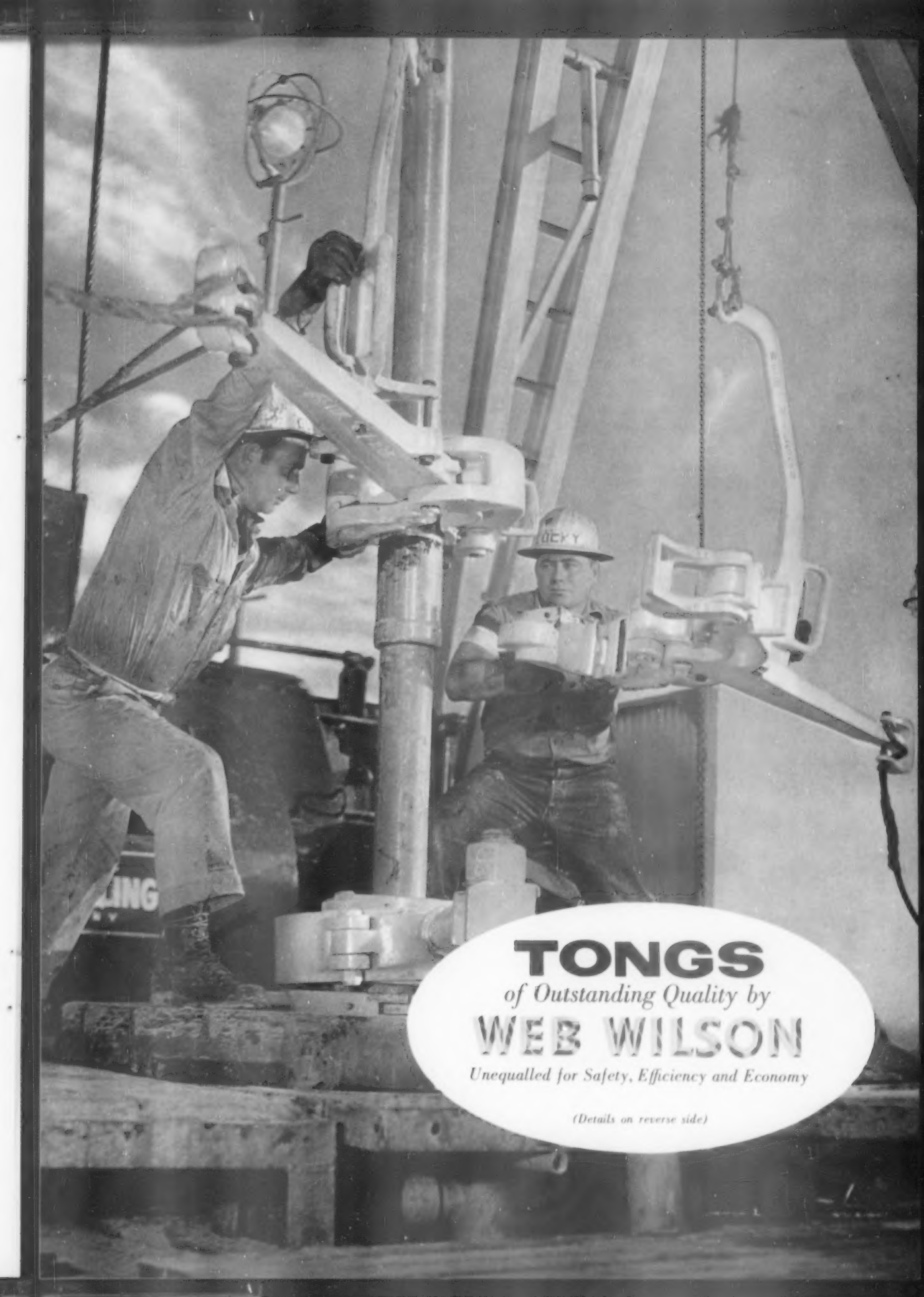
Write us for technical information and assistance on the use of Esteron® 245, Esteron Brush Killer, Esteron Ten-Ten*, 2, 4-Dow* Weed Killer, Formula 40—also Radapon* for grass control and Baron*, a new vegetation control product for extended control of both grasses and broad-leaved weeds. THE DOW CHEMICAL COMPANY, Agricultural Chemical Sales Department, Midland, Michigan.

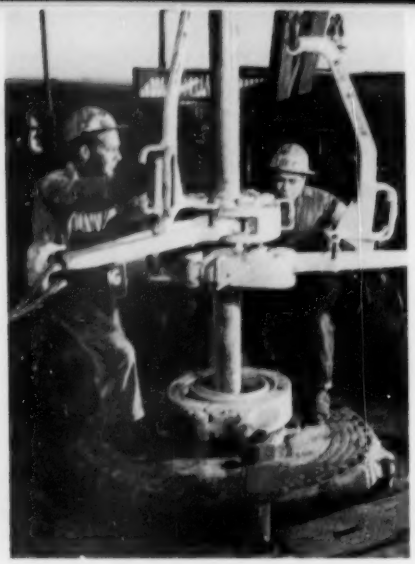
*Trademark of The Dow Chemical Company

Fire prevention and good housekeeping on premises call for Dow vegetation control chemicals.

you can depend on DOW CHEMICALS

DOW


TONGS
of Outstanding Quality by
WEB WILSON
Unequalled for Safety, Efficiency and Economy
(Details on reverse side)



YOUR FIRST IMPRESSION OF

Quality...

...is proved by top performance

YOUR FIRST LOOK at *any* Web Wilson Tong tells you "it's right for the job" and your *first* impression will be confirmed by long, safe, economical operation.

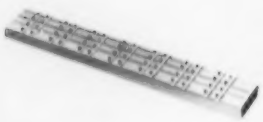
Quality IN TONGS IS MADE UP OF MANY THINGS

"SPIRAL" HINGE PIN ARRANGEMENT which equalizes pressures of all jaws against the pipe, as well as stresses on tong pins and jaws. You enjoy far greater safety—longer tong life—repairs are less—pins and dies last longer.

QUALITY of materials, with Manganese-Molybdenum steel used for all parts, which are then heat treated in our own plant. All parts are "Magna-flux" inspected both before and after heat treatment, and "Gamma-rayed" (on a quality control basis) to detect any possible internal defects.

QUALITY IN BASIC DESIGN so that you need to change *only one* Lug Jaw—not the entire tong head—to cover a wide range of sizes. This means less inventory, less confusion, and less cost.

QUALITY IN OPERATING PERFORMANCE, with a strong, safe, guarded "Stirrup-Type" Latch and a Self-Locking Safety Latch which insures against unlatching under load. Positive balancing, and ease of opening and closing are added vital features.



QUALITY LUBRICATED TONG HINGE PINS made of alloy steel *exactly right* for the job. They are precision ground, heat treated in our own plant, and the countersunk lubrication fitting guards against accidental damage. Breakage is less—and they last and last.

QUALITY IN TONG DIES because all Web Wilson Tongs are equipped with the famous TIGER TOOTH Tong Dies, never equalled for positive, safe gripping and long, low-cost service. Don't hamper the performance of *any* Web Wilson Tong by using inferior imitation dies.

it will pay you well to buy only . . .

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Rotary · Casing · Tubing

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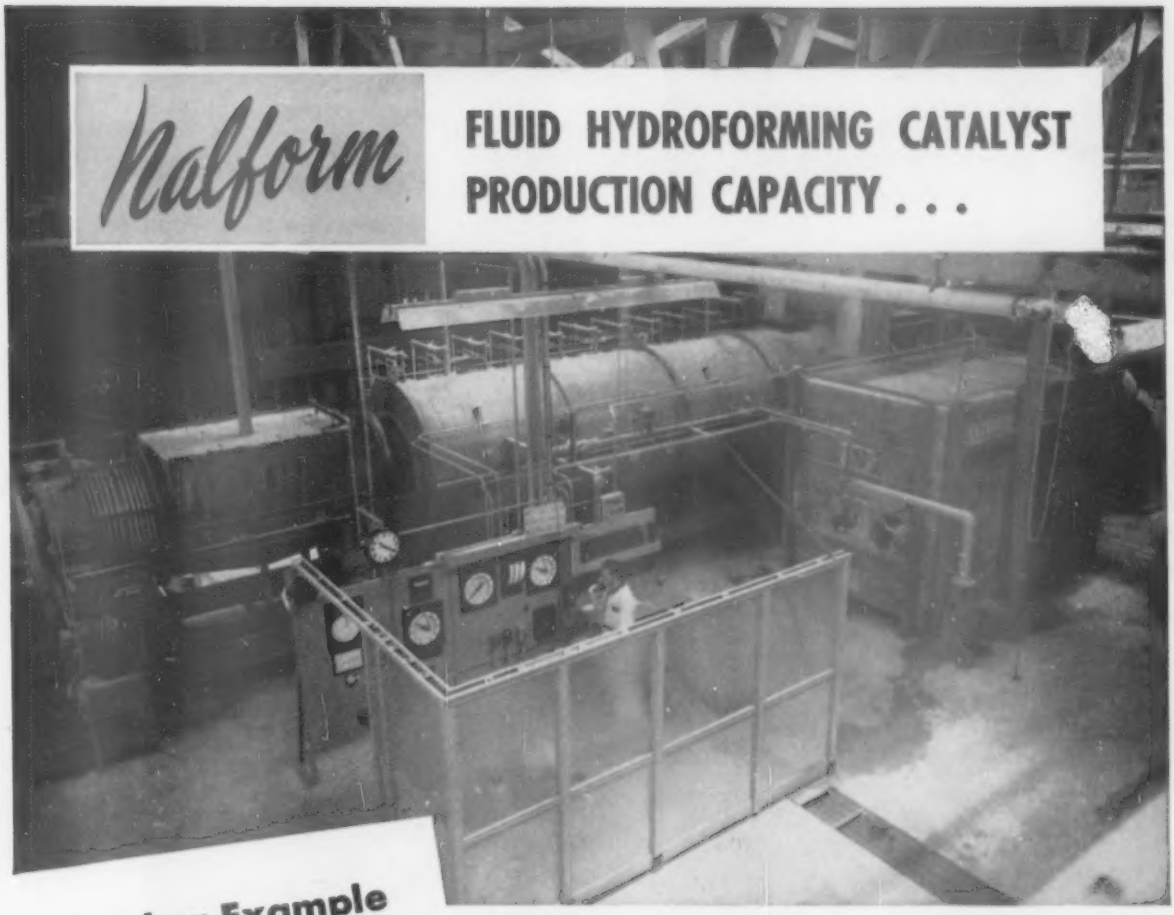

Nalform FLUID HYDROFORMING CATALYST PRODUCTION CAPACITY . . .

another Example of Service to further Petroleum Industry Progress

● Fluid hydroforming to upgrade petroleum products is one of the typically rapid advances in the Petroleum Industry that the Nalco Catalyst Division is proud to have had a part in making possible.

Standard Oil Development Company and Nalco Catalyst Division worked together in developing Nalform Hydroforming Catalyst. In a surprisingly short time, Nalform was being produced in commercial quantities.

Nalform and Nalcat Catalysts are good examples of the abilities and facilities of Nalco Catalyst Division to produce and provide service to match petroleum industry progress.

Nalcat · Nalform

Production and Service to Match Petroleum Industry Progress

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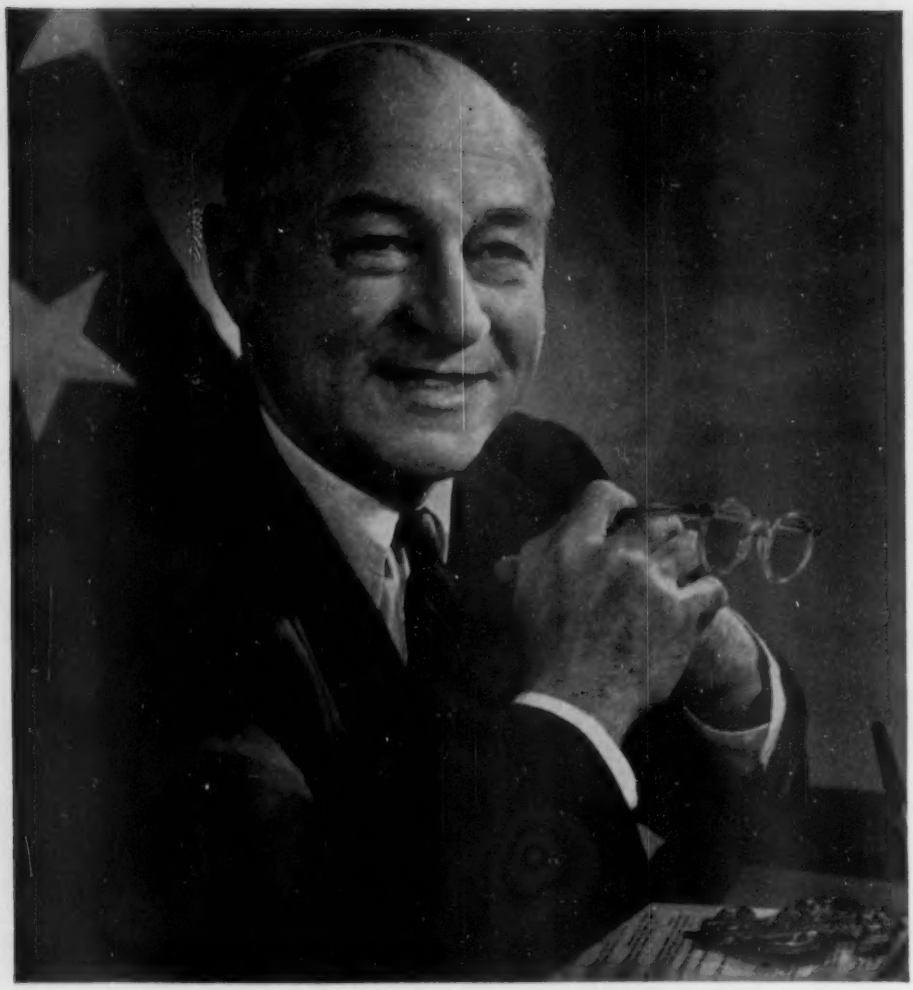

CONGRATULATIONS on Your 15th Anniversary

May 1st marked the Fifteenth Anniversary of the introduction of the Series E Savings Bonds. In a deeper sense it was *your* anniversary, because you, in 1941, helped to initiate and build a thrift movement new to America—The Payroll Savings Plan for the purchase of Series E Bonds.

In the intervening years millions of men and women have invested billions of dollars in Series E Bonds through the Payroll Savings Plan.

Today, forty million Americans hold Series E and Series H Bonds (the H Bond was introduced in 1952) with a cash value of more than $40 billion—a reservoir of future purchasing power. In addition, Savings Bonds have paid for college educations, new homes, retirements and other family needs.

To the executives of more than 40,000 companies that have the Payroll Savings Plan . . . the 8,000,000 employed men and women who invest $160 million per month in Series E Bonds . . . the publishers of 500 business papers and the managements of radio, television and other media who give freely of their space . . . the Advertising Council . . . the advertising agencies who contribute their skills . . . to *all* of you who have had a part in the success of the Payroll Savings Plan, the United States Treasury offers its heartfelt thanks.

George Humphrey

Secretary of the Treasury

THE OIL AND GAS JOURNAL
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Superior Performance

by all QCF Lubricated Plug Valves

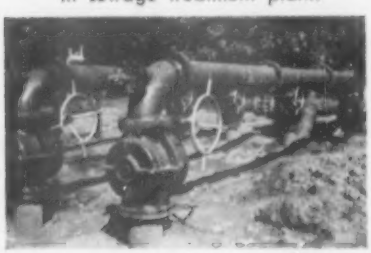
THIS TEFLON GASKET PREVENTS HEAD LEAKAGE— REDUCES TURNING TORQUE

* Gasket Characteristics

. . . Self lubricating
. . . Can't bind
. . . Unique shape maintains lubricant release
. . . Pressure tight.

On circulating water pumps in petroleum industry.

In sewage treatment plant.



Gas measuring station installation.

This Teflon* Gasket is another example why QCF lubricated plug valves are your best buy in round or rectangular port valves.

It not only gives greater protection against head leakage, greatly reduces turning torque, and operates in temperature to 450°F, but it also prolongs service life . . . and that means a substantial saving in valve maintenance costs.

Many years of field testing, plus years of industry service, have proved the importance of this feature in QCF valve performance. See your QCF Representative and learn why it pays to specify QCF valves.

* DUPONT TRADE NAME

5602

W-K-M MANUFACTURING COMPANY, INC.

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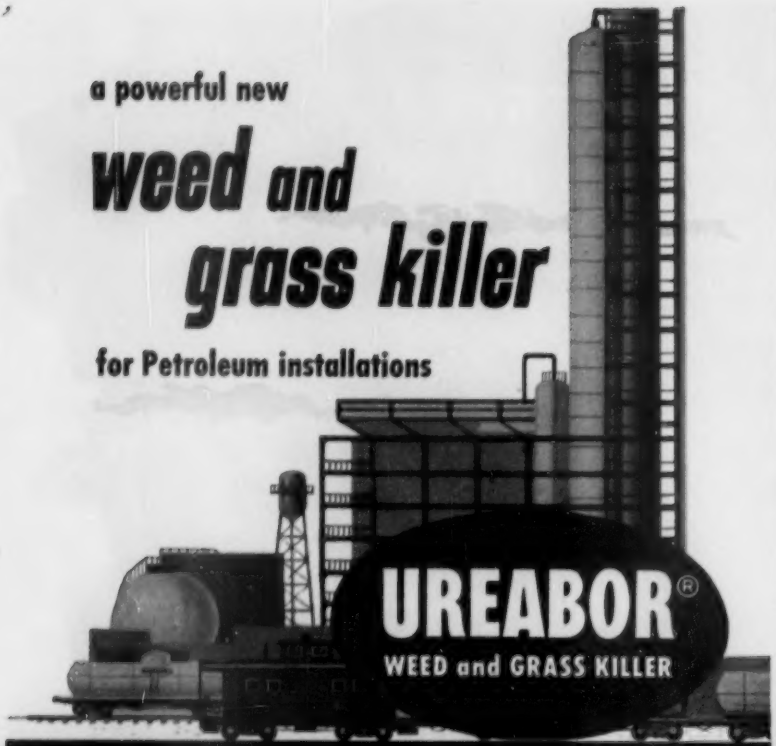
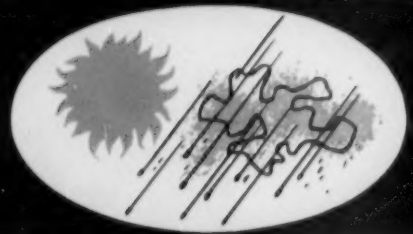
weed and grass killer

for Petroleum installations

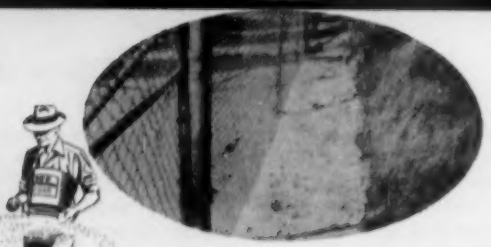


you get full season's control from one application!



PCB Spreader Makes Applying New Ureabor **AS EASY AS WALKING!**

A sturdy sling-strap unit made especially for fast, easy, accurate spreading of UREABOR at low rates. Holds enough UREABOR to treat 2500 sq. ft. at 1-pound rate. Simple action. Available at $10.75 delivered anywhere in the U.S.A.



UREABOR offers you release from your weed problems—with new ease and big economy. Never before, a weed killer like this! Apply it DRY—at thrifty, low rates. No mixing—no water hauling—just apply UREABOR direct from sack to weeds. Nothing could be simpler, or safer, to use anywhere. UREABOR is nonflammable, noncorrosive, nonpoisonous when used as directed... and effective!

AGRICULTURAL SALES DIVISION

PACIFIC COAST BORAX CO.

DIVISION OF BORAX CONSOLIDATED, LIMITED

630 SHATTO PLACE, LOS ANGELES 5, CALIFORNIA

They Say—

Bell Ringers:

Dear Sir:

Congratulations on your excellent feature "Finding Oil With Geophysics" (April 30, page 123-A). You have done both the geophysical industry and the oil industry an outstanding service.

This company would like to place an order for 50 reprints if they are available.

Paul L. Lyons
Chief Geophysicist
Sinclair Oil & Gas Co.
Tulsa.

Impressive Issue

Dear Sir:

We were quite impressed with your recent exploratory issue. To the extent that we have obtained 500 copies of the article "Finding Oil With Geophysics" which we thought unusually well presented. The information is factual and written in an appealing and mature manner.

Ben F. Rummerfield
Executive Vice President
Century Geophysical Corp.
Tulsa.

Reprints of The Oil and Gas Journal's special 12-page section, "Finding Oil With Geophysics," are available through the Journal's Reader Service Department at 50 cents per copy.

Grace Hails Merger

"Historically, much of our growth has been achieved through expansion into fields naturally related to present activities. A case in point is our recent proposal to merge with the Cosden Petroleum Corp. Let me take a moment now to explain the reasons behind this proposal.

"Cosden has an excellent record of growth and profitability. It has excellent management. It would give W. R. Grace & Co. a sound position in the petroleum industry and would fit in quite logically with our growing petrochemical activities. Cosden produces and refines oil, and also produces considerable quantities of such petrochemicals as benzene, toluene, and xylene. At a plant now under construction, Cosden will also shortly begin production of styrene—used in the manufacture of plastics and synthetic rubber. Petrochemicals are the heart of our newest large-scale chemical ventures. Perhaps I can emphasize the importance of petrochemicals by noting that in 1954, 25 per cent, by weight, of all

DESIGNS, ENGINEERS and BUILDS COMPLETE PACKAGED GAS COMPRESSOR PLANTS

Southwest erects complete gas compressor plants: engineering, compressors, building, on one purchase order and with single responsibility from beginning to end. Southwest does the complete job in building compressor stations afloat, on platforms, or on land giving you faster delivery, lower *installed* cost, and undivided responsibility.

The unattended operation, possible with the automatic controls and safety devices on Southwest Packaged Compressor Plants, cuts operating cost per horsepower-hour to a fraction of the cost of a fully attended stationary installation. A Southwest engineer can show you actual comparative operating costs.

FOR GAS LIFT, GAS BOOSTER, PRESSURE MAINTENANCE AND SIMILAR PROJECTS

SOUTHWEST INDUSTRIES, INC.

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Glitsch
Emergency
Service on
Emergency
Shutdown
Repairs get top priority in the Glitsch plant. You can always count on Glitsch to get you back on stream as quickly as possible.
The basic design of Glitsch "Truss-Type"® tower internals affords unusual protection against wreckage caused by explosions and serious bumps. Because of this, we are usually able to effect from 90 to 95 per cent recovery of Glitsch internals returned to us for repair. And after we expedite an emergency order through our plant we send back a complete set of installation drawings; too, if the services of our experienced field personnel can be used to assist your boilermakers in the initial hours of the installation, he is no farther away than your telephone. Because of Glitsch service like this, operators do not have to carry a large stock of fabricated parts for quick replacement.
Call Glitsch in on scheduled turnarounds, too. Regardless of the process, your project will be expertly fabricated according to all requirements, at competitive prices, and with a quality of workmanship that is unexcelled.
FRITZ W. GLITSCH & SONS, INC.
Dallas • New York
Tulsa • Cleveland
Chicago • Houston
Los Angeles • Uxbridge, Canada

chemical production in the United States was in products derived from oil.

"If the merger with Cosden is approved, we expect to gain large benefits through the pooling of Cosden's technical skill and know-how with our own. This pooled knowledge and talent will be the basis for still further expansion of our petrochemical activities, both in the United States and abroad."

J. Peter Grace, president of W. R. Grace & Co. in report to stockholders, New York.

Jobs Cost Money

"U. S. Steel's newest facility, Fairless Works, near Morrisville, Pa., required an investment of about $65,000 in plant and equipment for each person presently employed in that works.

". . . Last year at U. S. Steel, it took $15,300 worth of sales to maintain the job of each man and woman on our payroll, exclusive of those engaged in construction."

Roger M. Blough, board chairman of U. S. Steel Corp. in address to American Investment Bankers Assoication, White Sulphur Springs, W. Va.

Blow On the Head

Dear Sir:

Here at Petroleum Information we read with interest your article, "Finding Enough Oil Is the Challenge" in the April 30 issue of our "favorite yellow book." Your analysis of the situation certainly seemed to hit the entire production phase of the industry right on the head and was certainly interesting to me.

Maury Goodin
Petroleum Information
Denver, Colo.

Alcohol Fuel Too Costly

"Alcohol derived from grain would cost too much for fuel, and despite the politicians, this country cannot afford to use foodstuffs for conversion to gasoline.

"Even at $1.32 a bushel, which is slightly below the present support price, a gallon of alcohol from corn would cost 68 cents—more than six times the present refinery price for gasoline. And its heat content is only 62 per cent of that of gasoline.

"Perhaps the ultimate way of getting gasoline will be to start with a solar or atomic power plant. That power could be used to electrolyze water into hydrogen and oxygen. The hydrogen could be used to reduce carbon dioxide from the air to carbon monoxide, and the hydrogen and carbon monoxide could then be combined to make gasoline."

Dr. Robert E. Wilson, chairman of

LQ600 VALVES

• NO LEAKAGE • NO EROSION
• NO WIRE DRAWING
. . . In 100,000 applications and 5 years of tests

Famous LQ600 Bronze Valves, with revolutionary Brinalloy seats and discs, now solve maintenance problems in a new wider range of services!

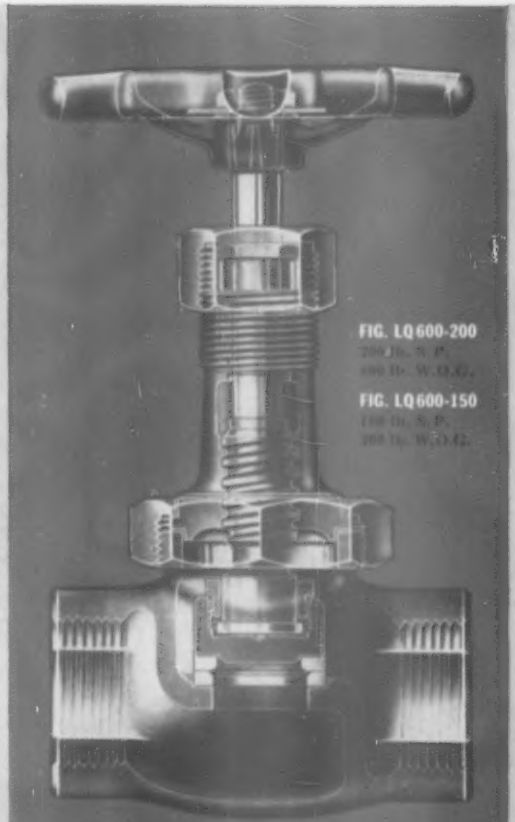
The lower pressure LQ600-150 made valve history during five years of cost-cutting use in a big variety of installations, ranging from "normal" to "exceptionally severe."

Now the higher pressure LQ600-200 offers all the same proved features — plus a stronger body and bonnet of exclusive Lunkenheimer S-1 Bronze. It has a total temperature rating of 550°F.

It will pay you to specify and install LQ600 in your toughest 150 and 200 lb. services. New Brinalloy seats and discs resist wear and corrosion to an amazing degree — far greater than 500 Brinell Stainless Steel . . . even outwear case hardened Stainless Steel exceeding 1000 Brinell. The flat seats and discs are micro-optically lapped to a perfect fit — and brazed in to stay.

Call your Lunkenheimer distributor or write The Lunkenheimer Company, Box 360, Cincinnati 14, Ohio.

BRONZE • IRON • STEEL • PVC



NOW AVAILABLE FOR
200 LB. S.P. 400 LB. W.O.G. and
150 LB. S.P. 300 LB. W.O.G.
APPLICATIONS

BRINALLOY* SEATS AND DISCS

*Patented Alloy —TM Reg.

LUNKENHEIMER®
THE ONE *Great* NAME IN VALVES

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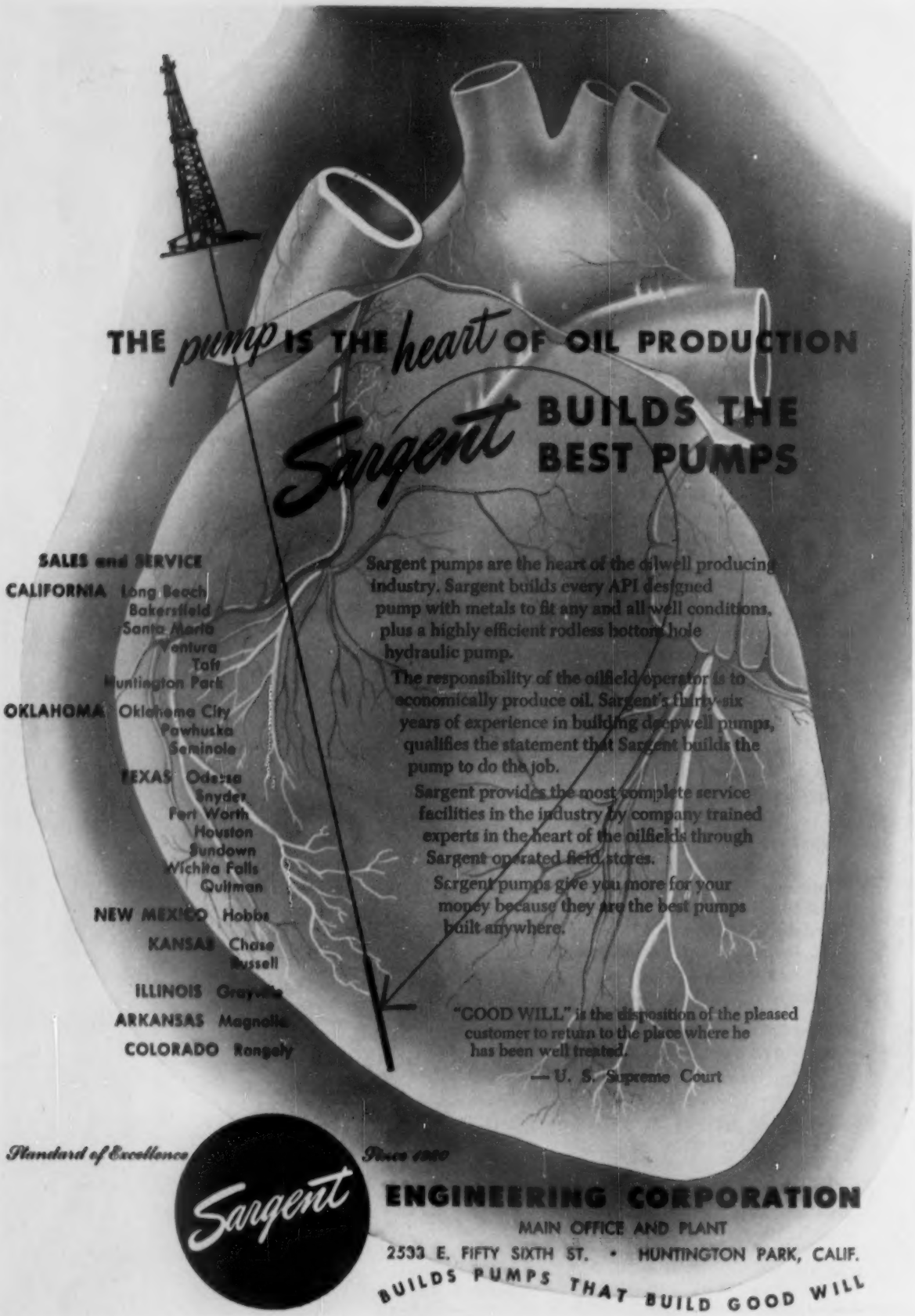


THE *pump* IS THE *heart* OF OIL PRODUCTION

Sargent BUILDS THE BEST PUMPS

SALES and SERVICE

CALIFORNIA Long Beach, Bakersfield, Santa Maria, Ventura, Taft, Huntington Park

OKLAHOMA Oklahoma City, Pawhuska, Seminole

TEXAS Odessa, Snyder, Fort Worth, Houston, Sundown, Wichita Falls, Quitman

NEW MEXICO Hobbs

KANSAS Chase, Russell

ILLINOIS Grayville

ARKANSAS Magnolia

COLORADO Rangely

Sargent pumps are the heart of the oilwell producing industry. Sargent builds every API designed pump with metals to fit any and all well conditions, plus a highly efficient rodless bottom hole hydraulic pump.

The responsibility of the oilfield operator is to economically produce oil. Sargent's thirty-six years of experience in building deepwell pumps, qualifies the statement that Sargent builds the pump to do the job.

Sargent provides the most complete service facilities in the industry by company trained experts in the heart of the oilfields through Sargent operated field stores.

Sargent pumps give you more for your money because they are the best pumps built anywhere.

"GOOD WILL" is the disposition of the pleased customer to return to the place where he has been well treated.

— U. S. Supreme Court

Standard of Excellence — *Since 1890*

Sargent

ENGINEERING CORPORATION

MAIN OFFICE AND PLANT

2533 E. FIFTY SIXTH ST. • HUNTINGTON PARK, CALIF.

BUILDS PUMPS THAT BUILD GOOD WILL

Standard Oil Co. (Ind.) in address accepting 1956 Washington Award from five leading engineering societies.

Still Free Market

"It may be a matter of regret that Canadians did not have enough faith in this project and enough organizing zeal to own a majority of the original shares in Trans-Canada.

"But fortunately we have not adopted the totalitarian point of view that the Government should decide what stocks an individual shall buy or sell. After a few months of public buy and sell decisions who knows in what country the majority of shares will be held. It could be Switzerland or Turkey or United States or Canada."

Editorial in Financial Post, Toronto.

One Cost Is Down

"It is encouraging to note a decline in the construction cost index on state highways since 1953, reversing the previous upward trend. One big reason for this is the rapidly improving efficiency of construction equipment.

"Some figures I saw recently, for example, showed that the productivity of one type of earth-moving machine was increased 87 per cent from 1947 to 1953—and in the next 2 years was increased another 45 per cent."

Albert Bradley, chairman of board of General Motors Corp., in address to Sixth Highway Transportation Congress.

How Are Dealers Picked?

"Price does not appear to play an important role in the choice of gasoline stations (by motorists).

"Yet almost half of those who regularly buy gasoline know within 1 cent the actual price they pay for it. And two-thirds of the people feel gasoline consumption should be a major factor in the selection of a new car."

Report on study of consumer opinion by Survey Research Center, Institute for Social Research, University of Michigan.

Imports Plan Attacked

"To infer that it is expedient to import raw materials and products into one section of the country (West Coast) and not to another serves only to take away the right of the industry to supply the entire nation. If one area of our nation is incapable of producing its needs, we should then look to the balance of the industry to supply that need.

"We must gear ourselves to produce our requirements in time of emergency.

How Do the Pumps You're Using Measure Up With

Precision **HARBISON-FISCHER ROD PUMPS**

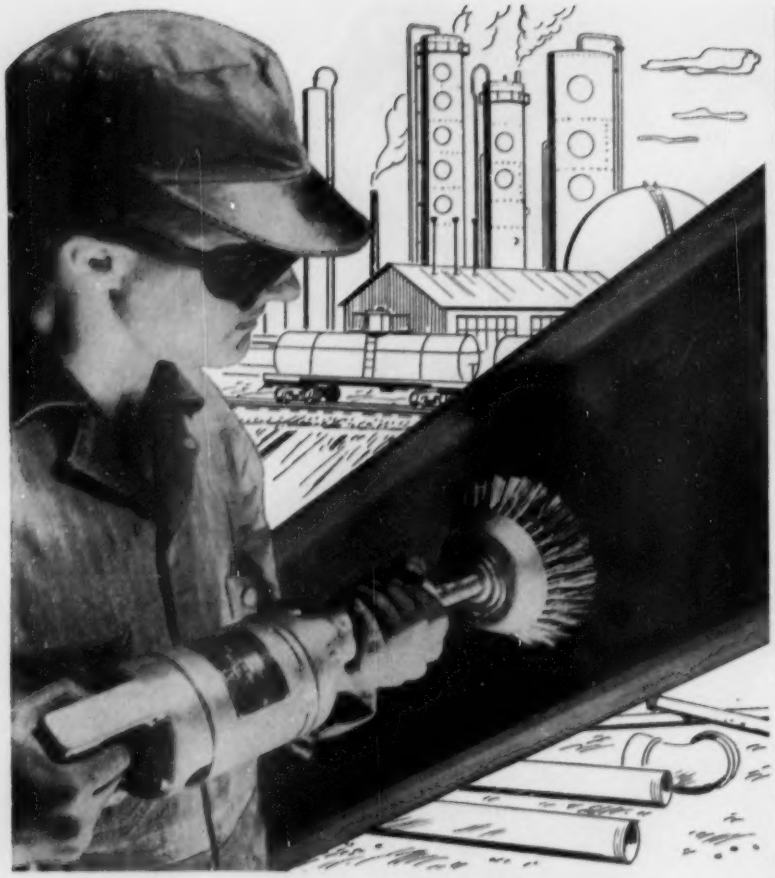
("BEST PUMPS IN THE OIL PATCH")

Tough, non-galling one-piece seamless steel barrel tube... machine-straightened and finished to a perfect inside working surface • Hardened, corrosion-resistant one-piece sectional plunger... permanently and perfectly aligned at the factory and accurately ground and polished to a mirror finish • Manufacturing tolerance of .0005" for these two vital working parts • Heavy-duty models... with an extra-rigid, double-thick barrel tube that won't flex or breathe in deep-well pumping • Stroke-thru models... with barrel extensions for pumping mineral solids, scale, gyp, or paraffin • Interchangeable A.P.I. parts...always available at leading stores throughout the Oil Patch • Backed by one of the largest sub-surface pump manufacturers in the world...whose only business is oil well pumping equipment.

H·F
OIL WELL PUMPS

HARBISON-FISCHER MFG. CO. • *Fort Worth*

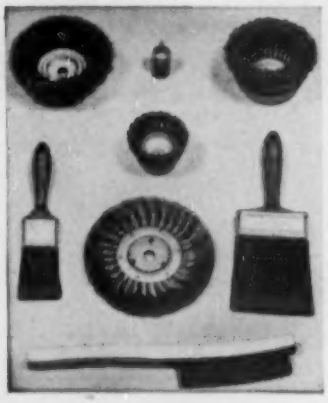
Representatives in All Major Producing Areas



Big jobs are easy jobs

HIGH speed Osborn power brushes take all the effort out of cleaning rust, scale and old paint from large metal surfaces. Rugged, special analysis wire quickly bites through the most stubborn rust and other surface crusts . . . keeps brushes in service longer.

For information on Osborn's complete line of top-quality industrial brushes, write for Catalog 210-B. *The Osborn Manufacturing Company, Dept. N-9, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



Osborn has a brush to meet every industrial need—power, paint or maintenance . . . and you get quality automatically when you specify "Osborn".

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

If we are denied the opportunity to do so, we can no longer progress, nor have we the incentive to grow. At this time, 1 year ago, our country had a policy; today the executive branch has shown a willingness to toy with one of its major industries, to cut up the nation, making portions dependent upon foreign imports."

Roy G. Woods, president Oklahoma Independent Petroleum Association, in telegram to Defense Mobilization Director Arthur S. Flemming.

Fight or Die

"If the oil industry's record of achievement is unfolded in its true light, we can defy with the utmost confidence the assaults of those who speak against us either in ignorance or malice.

"No industry can hold its head higher or belie its accusers more effectively than we can if we have the will to do so. We have a great story to tell and if we do not get it across to the American people we will have no one to blame but ourselves.

"Our standing at the bar of public opinion is today at the lowest level since the muck-raking era at the turn of the century.

"This situation calls for a militant industry, conscious of the importance of telling its story and possessed of the courage to challenge every unfair assault. What we must realize is that we are engaged in a battle for survival. We had just as well make up our minds that if we are not willing to fight and fight hard, we will face slow but certain extinction through the attrition of governmental controls and eventual complete nationalization. It is that simple—fight or die."

Walter S. Hallanan, president of Plymouth Oil Co., in address before Kentucky Oil and Gas Association convention, Lexington, Ky.

Instrument of Torture

Dear Sir:

"I should like to call your attention to a misprint in Article 3 of the A, B, C's of Instrumentation on page 139 of the April 23 issue. The paragraph at the bottom of the page has the heading of "new methods of temperature measurements." This should read "new methods of pressure measurements."

I feel that the articles on instrumentation are very well written and have been distributing copies of them to the instrument mechanics under my supervision.

G. A. Ludwig,
Instrument supervisor,
Atlantic Pipe Line Co.
Philadelphia, Pa.

CHANGE SETTING IN SECONDS!

Type A Controller

On The Versatile GUIBERSON TYPE A CONTROLLER

Adjustment for intermittent production at any given interval is just that quick on this Guiberson built unit. Lift the cover, set the adjusting screw at the point desired and the job is done. A series of fixed tabs on the revolving drum are spaced for different time cycles — five minutes, seven minutes, ten minutes, twelve minutes and other cycles that might be required. A broad range of injection intervals is provided, from a minimum of five minutes to a maximum of one injection per revolution of the two-hour clock. Accurate timing of the injection period is obtained by a simple screw and each cycle repeats with extreme accuracy. There are no loose pins or tiny adjustment parts — no special tools are required.

Extremely versatile, the same unit is easily adapted to continuous or intermittent gas lift production, purging, downsteam or up-stream pressure control of tubing or casing, tubing control, casing control, or combination tubing and intermitter control. In any of these applications the controller has a very low "on-off" operating differential. Pressure adjustments may be made very accurately, conveniently; and the control is positive. The entire unit is built of corrosion-resistant materials; is compact yet accessible, light but strong, extremely sensitive though sure in operation.

- 2" Line Pipe Threads.
- Cast Steel Body.
- 3,000 psi Test Pressure.
- 1,500 psi Working Pressure.
- Stainless Steel Stem.
- "TEFLON" Stem Packing.
- "COLMONOY" Ball and Seat.
- Steel Drip Chamber with Monel Screen.
- Corrosion Resistant Materials in Controller Parts.
- Weather Proof Aluminum Cover.

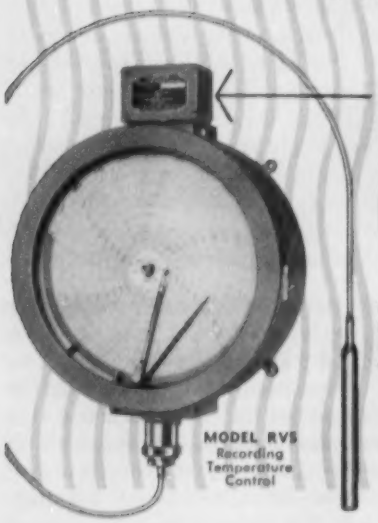
THE GUIBERSON CORPORATION

ESTABLISHED 1919 • DALLAS, TEXAS, U. S. A.

Sold By Leading Oil Field Supply Stores Everywhere

Special
"Vest-Pocket"
controls
for
HAZARDOUS LOCATIONS!

SEND FOR BULLETINS


SELF-ENCLOSED SWITCH mounted on control . . . one low cost . . . no bulky extra enclosure to buy or make room for.
U. L. APPROVED — for Class I, Groups C and D; Class II, Groups E, F and G.
MODEL RVS Recording Temperature Control

Vest-pocket size! Vest-pocket price! Recording, Indicating and Non-Indicating Explosion-proof Controls for use with gas, oil, steam or water valves, or with electrical equipment. –30F to 1200F ranges. Single pole double-throw switch permits use in two-wire or three-wire circuit; or in two-wire AC circuits, with extra terminal for actuating signals, timers, stirring mechanisms, dampers, etc. when control temperature is reached.

WRITE FOR BULLETINS

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the pioneer in mercury thermal controls

Offices in All Principal Cities
THE PARTLOW CORP. • NEW HARTFORD, N. Y.
Export Office: Ad Auriema, 89 Broad St., New York

"Here comes your QD Sheave—the original two-piece design."

Did we say quick delivery!

Hope to tell you we said quick delivery. Meant it, too. On Worthington QD sheaves and Worthington-Goodyear V-belts the delivery you get couldn't be quicker.

QD stands for Quick Detachable—a perfect monicker for the original two-piece sheave because it's so easy to get on and off the shaft—holds tight, too.

And when you're using QD sheaves and V-belts you've got no supply problem. Your Worthington distributor (or local supply store) stocks most sizes—can get others rushed from nearby warehouses. Call him today and say Worthington "QD"—for Quick Detachable and quick delivery. MV44

WORTHINGTON

Buy These Worthington Standard Products From Your Local Distributor

COMPRESSORS • PUMPS • MULTI-V-DRIVES • VARIABLE SPEED DRIVES

CALENDAR OF EVENTS

JUNE

12 A.G.A. rate committee, Shamrock Hilton Hotel, Houston.

13 I.N.G.A.A. rate committee, Shamrock Hilton, Houston.

13 Pennsylvania Grade Crude Association, thirty-third annual meeting, Bradford, Pa.

14-16 American Society of Mechanical Engineers, applied mechanics conference, University of Illinois, Urbana, Ill.

14-16 National Oil Scouts and Landmen's Association, thirty-third annual convention, White Plaza Hotel, Corpus Christi, Tex.

17-21 American Society of Mechanical Engineers, semiannual meeting, Statler Hotel, Cleveland.

17-22 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Atlantic City, N. J.

17-23 World Power Conference, Vienna.

21-22 Western Petroleum Refiners Association, regional technical—industrial relations meeting, Broadview Hotel, Wichita.

21-23 American Association of Petroleum Landmen, annual convention, Denver.

25-29 American Institute of Electrical Engineers, 1956 summer and Pacific general meeting, San Francisco.

26-29 Canadian Gas Association, Manoir Richelieu, Murray Bay, Que.

28-30 Rocky Mountain Oil and Gas Association, board of directors, Hotel Utah, Salt Lake City.

JULY

9-11 American Gas Association, American Petroleum Institute, Canadian Petroleum Association, committees on natural gas reserves, Banff, Alta.

17-27 Program on Recent Advances in Catalytic Polymerization, Massachusetts Institute of Technology, Cambridge, Mass.

18-20 Yellowstone-Bighorn Research Association, third Professional Short Course on Uranium Occurrence and Structural Geology, Red Lodge, Mont.

AUGUST

2-4 Rocky Mountain Mineral Law Foundation, Second Annual Institute, University of Colorado, Boulder.

20-21 North Dakota Oil and Gas Association, annual meeting, Bismarck, N. D.

27-29 Sixteenth Annual Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

SEPTEMBER

5-7 Wyoming Geological Association, eleventh annual field conference, Jackson Lake Lodge, Moran, Wyo.

9-12 Independent Natural Gas Association of America, annual membership meeting, St. Anthony Hotel, San Antonio, Tex.

11-13 Pacific Coast Gas Association, annual meeting, Coronado, Calif.

12-14 National Petroleum Association, annual meeting, Traymore Hotel, At-London, N. H.

13-15 Chemical Institute of Canada, third Western Regional Conference, Edmonton, Alta.

16-18 New Mexico Petroleum Industries Committee, annual convention, Hilton Hotel, Albuquerque.

16-21 American Chemical Society, 130th

Safety for an aircraft test facility at Pratt & Whitney Aircraft Plant, using BS&B Model DV Rupture Discs.

BS&B SAFETY HEADS

Now Handle Even "Tougher" Applications With The New Model DV Rupture Disc . . .

FEATURES OF THE MODEL DV DISC

- ✔ Unrestricted, Instantaneous Opening In Sizes 1" Through 36".
- ✔ Greater Safety — Operates Closer To Disc Rupture Pressure.
- ✔ Minimizes Metal Creep Due To Elevated Temperatures And Pressures.
- ✔ Pressure Ratings: 5 lbs. To Several Hundred Pounds.
- ✔ Temperature Ranges: Sub-Zero To 900° F.

- **High Temperature**
- **Alternating Pressure and Vacuum**
- **Cycling**
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USE BS&B SAFETY HEADS!

Utilize Our Research Facilities In Selecting Model DV Discs For "Tough" Applications.

BLACK, SIVALLS & BRYSON, INC.

Safety Head Division, Dept. 2-A6
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BS&B — ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

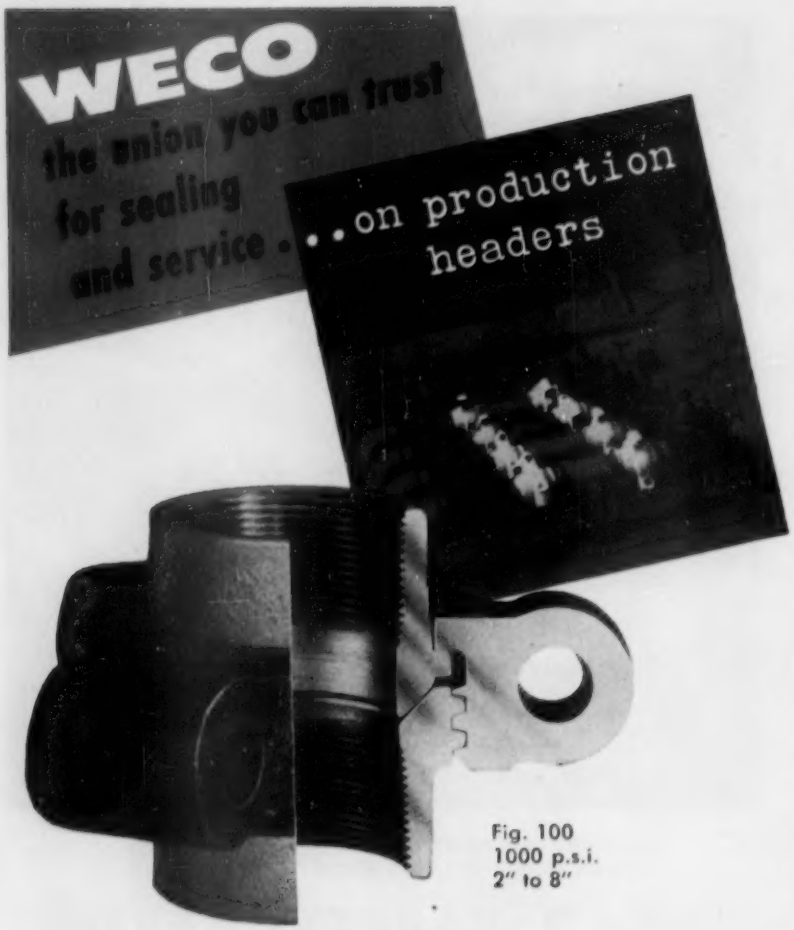

Fig. 100
1000 p.s.i.
2" to 8"

Dependable, long-lasting, leak-proof service is the principal requisite of unions on production headers. And **WECO** Unions are the perfect answer to these requirements.

Their famous ball and cone seat is precision-machined so that the spherical surface on the male sub seats perfectly on the conical surface of the female sub – thus assuring a positive, leak-proof seal.

That's why – for production headers or any other oil industry services – you'll do better by using **WECO** Unions.

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WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

WECO

Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

annual meeting, Atlantic City, N. J.

16-21 American Society for Testing Materials, Second Pacific Area National Meeting, Statler Hotel, Los Angeles.

17-21 Instrument Society of America, eleventh annual international instrument-automation conference and exhibit, New Coliseum, New York City.

20-21 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Hotel Henning, Casper, Wyo.

20-21 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual membership meeting, Roosevelt Hotel, New Orleans.

24-26 American Society of Mechanical Engineers, petroleum mechanical engineering conference, annual meeting, Statler-Hilton Hotel, Dallas.

26-28 Rocky Mountain Mineral conference, American Institute of Mining, Metallurgical & Petroleum Engineers, Newhouse Hotel, Salt Lake City.

OCTOBER

2-3 Texas Mid-Continent Oil and Gas Association, thirty-seventh annual meeting, Rice Hotel, Houston.

2-4 National Association of Corrosion Engineers, south central region, Beaumont.

7-9 American Association of Oil Well Drilling Contractors, annual meeting, Texas Hotel, Fort Worth.

11-12 California Natural Gasoline Association, fall meeting, Sheraton Hintington Hotel, Pasadena, Calif.

14-17 American Institute of Mining, Metallurgical & Petroleum Engineers, Petroleum Branch, fall meeting, Biltmore Hotel, Los Angeles.

14-20 OIL PROGRESS WEEK.

15-17 American Gas Association, annual meeting, Atlantic City, N. J.

18-19 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

18-21 Permian Basin Oil Show, Odessa, Tex.

22-24 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

29-30 Illinois Geological Survey, Petroleum Engineering Conference on Waterflooding, University of Illinois, Urbana, Ill.

29-Nov. 1 Society of Exploration Geophysicists, annual meeting, Roosevelt Hotel, New Orleans.

NOVEMBER

7-8 Philadelphia section, Instrument Society of America, Symposium on Process Data Logging, Stratford Hotel, Philadelphia.

8-9 American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, Pacific Coast Joint Regional Meeting, Ambassador Hotel, Los Angeles.

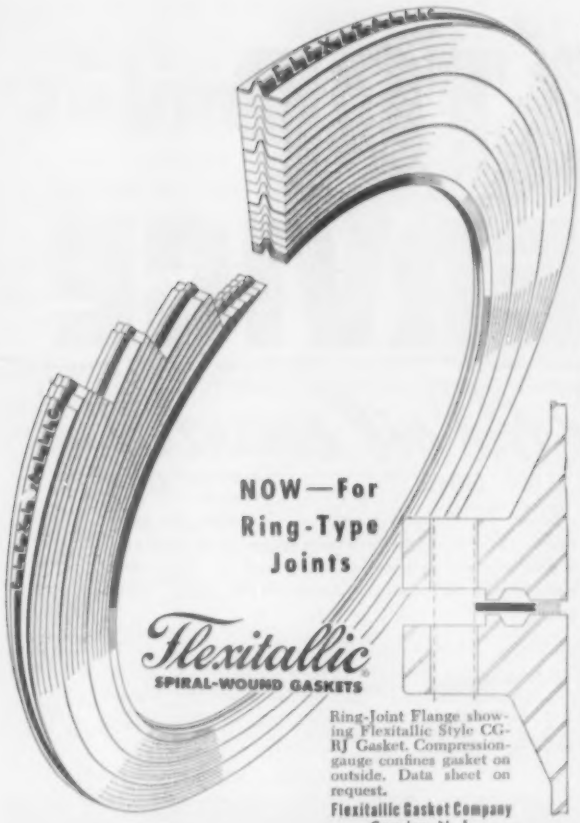
12-15 American Petroleum Institute, annual convention, Conrad Hilton Hotel, Chicago.

19-20 American Institute of Mining, Metallurgical & Petroleum Engineers, North Texas Secondary Recovery Symposium, Municipal Auditorium, Wichita Falls.

25-30 American Society of Mechanical Engineers, Statler Hotel, New York.

JANUARY (1957)

14-16 Pipe Line Contractors Association, ninth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.



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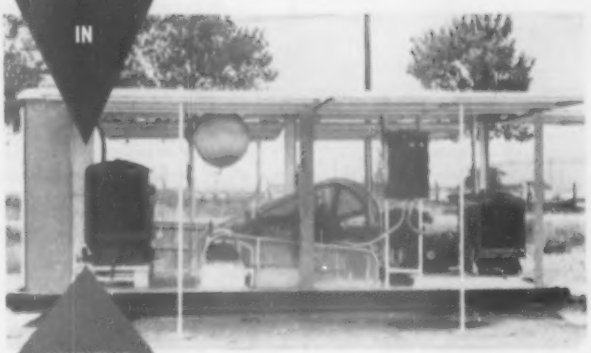

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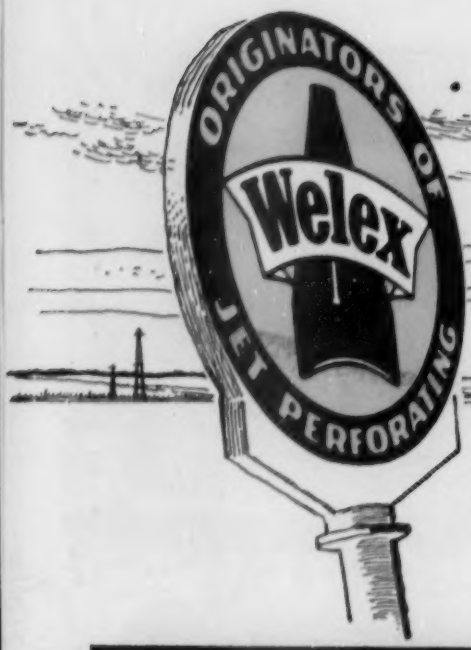

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the OIL AND GAS JOURNAL

TULSA, OKLAHOMA

Published every Monday by The Petroleum Publishing Co., 211 South Cheyenne Avenue, Tulsa, Okla. Phone Diamond 3-6291. Founded in 1902. Name changed to The Oil and Gas Journal in 1910 by Patrick C. Boyle.

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JOURNALLY SPEAKING . . .

How to See the Mountains

IT'S not to early to plan your summer vacation, and we strongly recommend the Rocky Mountains. There is much to see and do to suit all tastes and avocations, and some marvelous experiences await you. Horseback riding, for example.

Last summer our daughter talked us into taking a horseback trip up the Grand Tetons. This was a mistake, because we never were much of a horseman and hadn't been within smelling distance of a hay burner for 20 years, but we were too proud to admit it.

So, with misgivings and crossed fingers, we arranged to rent a couple of trusty steeds for a trip to Lake Solitude. The rustler, or hostler, or whatever they call the man in charge, assured us that the horses were docile, steady, used to unskilled riders, and knew the trails perfectly. We should reach the lake well before noon, he said, and if we started down at 2 we would be back about 4.

Our nag was named Moto. He did seem very gentle; in fact, quite disinterested in the whole procedure. He acted as though he hadn't had much sleep the night before. Nor much to eat, either. He had to stop and take a bite out of every succulent bush and clump of grass.

All went reasonably well until we reached a fork in the trail. One branch headed up the mountain and the other was a self-guided nature walk along the lake shore. Moto thought we should study nature at low altitudes. Politely but firmly he declined to go up the grade. We dismounted, patted him, and talked to him kindly to gain his confidence. This only put him to sleep.

"What's the matter, Daddy, has your Moto stalled?" the daughter called out in gay derision. Having practiced riding at an Ivy League college in the East, she was doing somewhat better than we were.

So we led the reluctant beast up the slope to a place where the trail was too narrow for him to turn around, and then climbed aboard. But at the next wide spot Moto turned back downhill. Again we got off and dragged him a while; good idea to stretch the legs, anyway. By resting the worn-out piece of crowbait in that manner every quarter mile or so we managed to make a little progress. But soon the daughter's nag developed Moto's need for much food and rest. We didn't want to overheat the horses on the steep trail, so we let them get their wind whenever they needed it. Anyway, we could enjoy the scenery while they grazed.

Those horses knew the trail, all right. They knew every good place to stop or to turn back to the barn. And they were worse than a 2-year-old child when it came to needing frequent drinks of water.

At one point Moto decided we should visit some campers near the trail, so he walked right into their campfire. As we dismounted and led him away we affected a Brooklyn accent so that nobody would suspect we were from the cowboy country of Oklahoma, and explained that, heh, heh, our horse suddenly developed a slight attack of spavins and had to be walked a while.

At 1 o'clock we reached a clearing where a sign informed us that it was 3 miles farther up to Lake Solitude and 5 miles back to our starting point. The horses stopped in their tracks. Without a word we dismounted and ate our lunch. Lake Solitude's solitude would not be disturbed by us.

On the way back those refugees from the glue factory did a little better, but seemed completely worn out from their hard morning climb.

The sun was setting when we got back to the corral, and the wrangler was getting worried. But when he saw the horses he burst out laughing.

"Why, these horses haven't done anything today. They knew they had a couple of greenhorns and took advantage of you. Why didn't you get sticks and wallop them?" Now he tells us.

We moved to a cabin that had a fireplace, so we could eat off the mantle for a couple of days.

We strongly recommend a vacation in the Rockies. Their beauties can readily be enjoyed from paved highways, easily traveled by motor (not Moto). Thank heaven for petroleum and automotive age.

Henry D. Ralph.

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State regulations need overhauling

WHENEVER an opportunity arises to save money, time, and manpower, the oil industry usually jumps at it with enthusiasm.

Such an opportunity exists in the proposal to simplify and standardize the report forms and control practices of the various oil and gas states.

The idea is being considered by the regulatory practices committee of the Interstate Oil Compact Commission. A subcommittee of industry volunteers is surveying the possibilities and hopes to have preliminary recommendations next winter. A show of interest and a little pushing from the industry could speed the process.

A BIG DOLLAR SIGN can be hung on this project. Operators spend untold man-hours making out routine reports for state agencies. They have to work up the same information in different forms for different states. The operators use the data for their own purposes, but in still different forms. Uniformity here could save mountains of paper work.

When a crew is sent to another state it has to be taught a whole new system of taking well potentials, applying for drilling permits, reporting completions and pluggings, classifying wells, accounting for production, and so on. This costs money, but failure to comply with some quirk of local practice can cost even more in delays and rectification of errors.

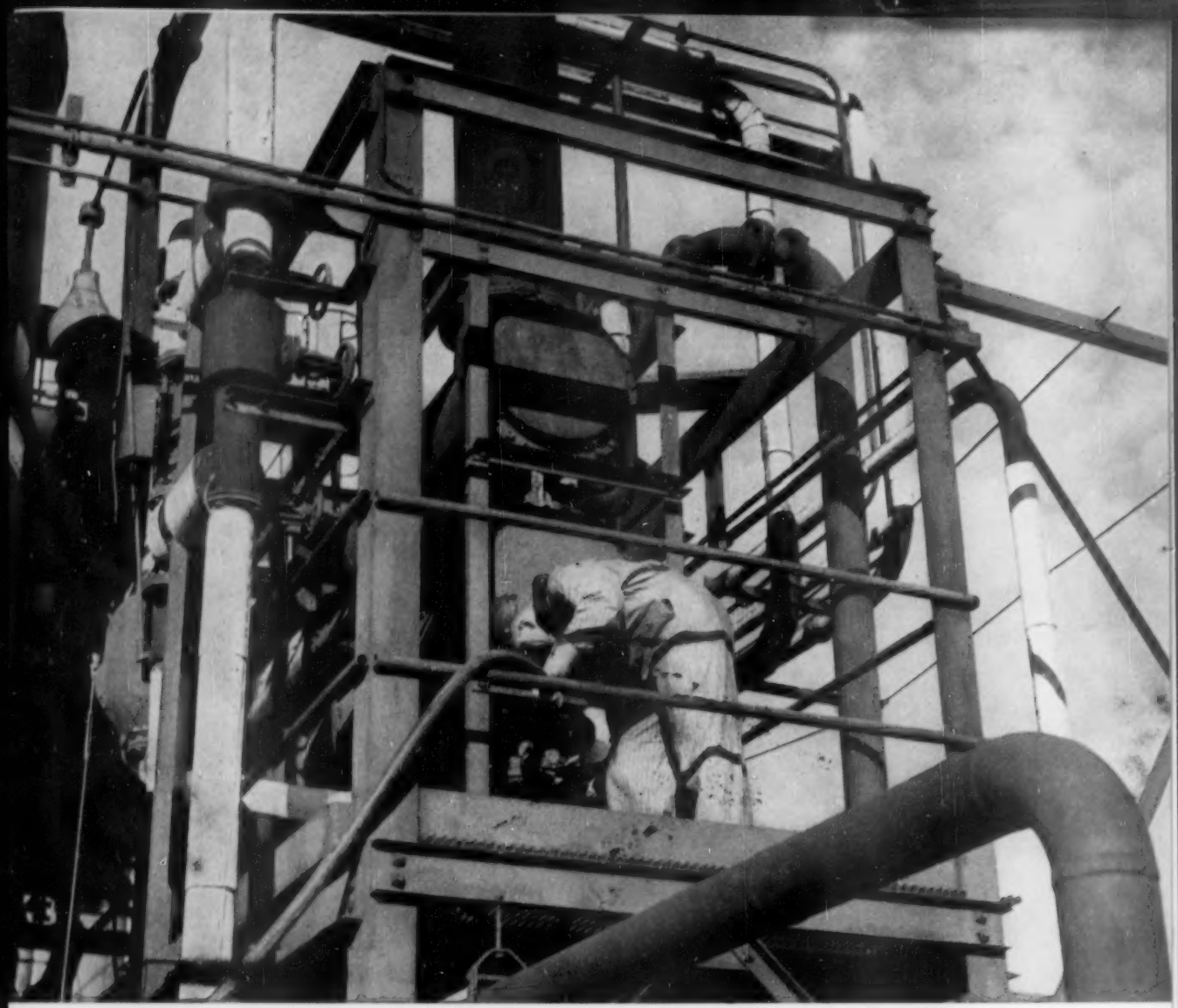
Taxpayers, too, could be saved money by streamlining the report procedures and regulatory practices of the state bodies. In this case the taxpayers usually are the oil producers, for most conservation agencies are financed by a small production tax. This gives producers an added reason—and an added lever—for pressuring state authorities to modernize procedures to better serve the industry.

The whole industry would gain from more uniform and meaningful statistical reports on drilling and production. In these days when figures are so important, the state bodies by and large are not contributing all they could. Some states don't make any worth-while compilations of all the reports they require. Those that do often use individual systems that don't jibe with the industry's statistics.

WHILE THEY'RE AT IT, the state agencies ought to take a hard look at whether or not all the tests and reports they require really serve a useful purpose under present conditions. There's good reason to suspect that many of them are outmoded and unnecessary.

Also, why not make all report forms adaptable to mechanical or electronic tabulation? State agencies may as well join the industry in the money-saving trend toward automation.

State officials generally aren't averse to the project, but there's the old problem of inertia. A little initiative from the industry could bring some gratifying and dollar-saving results.



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The Industry This Week

Pipelines

• **Trans-Canada will start laying pipe July 1** on the Alberta-Winnipeg leg of the 2,250-mile natural-gas line. Parliament approved the $72-80 million loan for the western section last week after almost a month of bitter debate. It climaxed a 5-year struggle to line up backing for the world's biggest pipeline. P. 82.

Combustion-gas turbines are getting their first use on a major crude line in the Middle East. Tapline will use them in four auxiliary pumping units to step up its capacity. Units also will be portable and unattended. P. 102.

Two new crude lines on the boards will provide important outlets for oil production. Union Oil Co. plans a 225-mile line from southern San Joaquin Valley to its 45,000-bbl. refinery at Oleum. P. 93. . . . Gulf Oil also will lay a 33-mile, 8-in. line from Citronelle field in Alabama to its dock facilities at Mobile. P. 97.

Exploration

• **Venezuela has accepted** final sealed bids on 110,000 hectares of prized exploitation concessions and is ready to grant its first new concessions in 11 years. Stakes are high both for the government and competing oil firms. P. 100.

Guatemala also has moved a step nearer granting its long-awaited concessions. It declared 17 companies eligible for all the acreage they requested and ruled 5 others eligible for varying amounts. P. 105.

An 85-ft. pay zone has been logged in an East Texas wildcat drilling on a nonproductive salt dome. Oil-saturated sands were found in the Woodbine plus shows in the Eagle Ford. P. 91.

The Cardium sand is back in the news in Alberta. Amerada and California Standard have opened a new Cardium oil pool 4½ miles northwest of Texaco Exploration production in the Alhambra-Cardium field. P. 97.

Industry

• **One of the industry's biggest** cash payments—$200 million—has finally given Atlantic Refining Co. the oil and gas properties of Houston Oil Co. P. 84.

Jersey Standard officially has invaded the rich midwest marketing field. It took over Pate Oil Co. of Milwaukee last week and quickly sent its marketing experts to take charge. Other moves are now expected. P. 87.

Refining

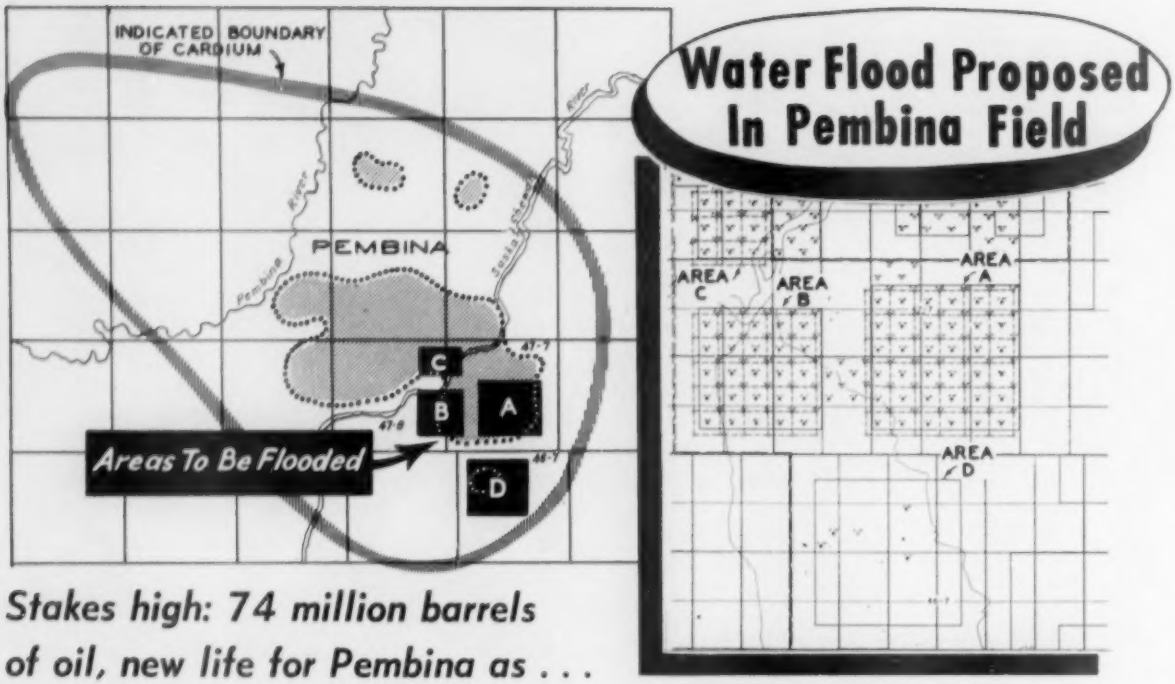
• **Road ratings of motor fuel** are looming more important to the refiner. High-compression engines play down research octane ratings in favor of road ratings. Some ways of getting better road ratings were outlined at the S.A.E. meeting in Atlantic City. P. 88.

Capacity of British American's Clarkson, Ont., refinery will be almost tripled. Contracts have been let to jump the throughput from 21,500 to 61,500 bbl. daily. P. 90.

Drilling-Production

• **A warm water flood planned** for a 11,200-acre block of Canada's Pembina field holds prospects of a big payoff: 74 million extra barrels of crude and 22 to 27 years additional production life. P. 80.

Special rock bit for turbodrilling will be developed by Hughes Tool Co. The American manufacturer has signed an agreement with the French firm, Neyrpic, turbodrill makers, for technical information and aid. P. 105.



Stakes high: 74 million barrels of oil, new life for Pembina as . . .

Warm-Water Drive May Bring Big Payoff

CALGARY.—The outlook is considerably brighter that Canada's sprawling Pembina field may have a long productive life—if given a hot water-flood treatment.

Prospects are that a large part of the field's 200,000 acres or more of proved Cardium-sand pay is suitable either to water flood or gas injection. Water flooding alone, at least in some areas, may more than double total oil recovery and add from 22 to 27 years to Pembina's life.

This optimism is based on a massive engineering study of the Cardium under 11,200 acres in the Buck Creek and Wolf Creek areas. It was conducted by James A. Lewis Engineering, Inc., Dallas, for a group of Pembina operators headed by Canadian Seaboard Oil Co.

The operating group in addition to Canadian Seaboard includes Bailey Selburn Oil & Gas, Ltd., Honolulu Oil Corp., Merrill Petroleums, Ltd., Canadian Petrofina, and Great Plains Development Co. of Canada, Ltd.

What it shows . . . The study was made to define the primary reserves of the Cardium in the specific area and to predict the added oil reserves to be gained by secondary recovery.

The Lewis firm, a recognized authority on water-flood projects, found that primary-oil recovery from the Cardium would be disappointingly low. It estimated the ultimate primary recovery at 32,624,000 bbl. of oil and 69,448,000 M.c.f. of gas in the Buck Creek-Wolf Creek area. Total oil in place for the area was estimated at 248,127,000 bbl. This meant a recovery of only about 13 per cent, and death for the area in about 15 years.

This isn't exactly cheering news. But a further Lewis finding that the Cardium can be flooded and that it will yield tremendous volumes of extra oil offsets the pay's primary shortcomings.

Lewis estimated that warm water injections would boost ultimate recovery to 107,034,000 bbl. of oil and 52,341,000 M.c.f. of gas. This is a gain in reserves of 74,410,000 bbl. of oil. The returns are dazzling—a bonus of 63,845,198 bbl. of oil to the operators and 10,564,802 bbl. extra royalty to the crown from the 11,200-acre block.

On the basis of his study, Lewis recommended that the Canadian operators immediately launch a full-scale flood of the acreage using the warm water. He explained that warm water would recover nearly five million more barrels of oil than cold water and permit higher input volumes.

The operators lost no time in acting. Canadian Seaboard applied to the Alberta Petroleum and Natural Gas Conservation Board for a permit to water flood the group's holdings along lines of the Lewis plan. The board quickly granted permission to initiate the flood program.

Construction is now scheduled to start this month on the plant and equipment for carrying out the program.

Cause for concern . . . Pembina's future has been a source of concern to the board members and operators alike.

The huge field is little less than 3 years old and still isn't really defined. There are roughly 1,100 wells now on production. The wells in much of the field are widely scattered. But there are some areas, such as that held by the Canadian Seaboard group, where development is almost complete.

Despite their youth, Cardium wells in some of these developed sections have been showing disturbing drops in pressure and climbs in gas-oil ratios. A number of wells in these areas have been unable to make their allowables.

Canadian Seaboard, one of the early operators in the field, became convinced almost a year ago that something should be done to increase recovery. It persuaded its partners to hire the Lewis firm for a survey.

The study, as suspected, shows that Pembina's reservoir drive is almost certainly solution-gas—the poorest form. It reported that no well has penetrated the gas-oil or oil-water contact. Pressure shows a rapid decline. Other areas yield from oil structures higher and

lower than the Buck Creek-Wolf Creek areas. All these factors lead to the conclusion that the reservoir energy is solution gas.

Exhaustive core tests showed the Cardium is oil-wet, with high oil saturation and very low connate-water content. Laboratory studies also showed a large percentage of the oil is mobile under a water drive.

Gas injection, Lewis reported, would recover only a small percentage more oil than a water flood under bulk of the acreage. However, gas injection might be feasible in one area of the group's holdings around Buck Lake. There the limited data available showed the sand has much less permeability.

The oil-wet nature of the Cardium, Lewis added, means that much oil would be left in the reservoir following a flood. This suggests that ultimate oil recovery might be boosted further by injecting propane prior to water or using carbon dioxide in water.

Pembina and the Cardium . . . Most geologists agree that Pembina is a tremendous undersaturated sand body of the stratigraphic-trap type. It feathers out in all directions into impermeable shaly sand and shale.

The discovery well was drilled in July 1953 by Socony, now Mobil Oil of Canada, Ltd. Production climbed steadily until today the field is producing about 100,000 bbl. of oil daily.

Depth of the Cardium averages about 5,000 ft. Dip is to the southwest at a rate of about 33 ft. per mile and the structural relief in the field is in excess of 1,100 ft. The pay varies from a shallow top layer of conglomerate through 20 to 35 ft. of fine-grained clean sand to a 35-50 ft. bottom strata shaly sand. The great bulk of the recoverable oil lies in the middle fine-grained sand zone.

Areas involved . . . The holdings of the operating group were consolidated into four general areas under the Lewis survey. They include:

. . . Area A. It contains 5,760 acres in Buck Creek, is essentially developed with cumulative oil production up to January of 1,454,000 bbl.

. . . Area B. It has 4,000 acres and is located just west of A in the Buck Creek and Wolf Creek areas. It is two-thirds developed with cumulative production of 499,000 bbl.

. . . Area C. This block is located north of B, containing 1,440 acres in the Wolf Creek region. It is essentially developed and is judged the most favorable for injection. Its cumulative production is 571,000 bbl.

. . . Area D. It is in the Buck Lake region and has 5,760 acres with only five widely scattered wells. Cumulative production is 76,000 bbl. Limited information on this area suggests the gas injection might be best because of lower permeability. It was not recommended for water flooding.

Lewis estimated that combined production of Areas A, B, C, currently would total about 14,000 bbl. daily.

Flood plan . . . Lewis proposed the most feasible pattern would be units of 160 acres with five closed spots.

This would require conversion of alternate 80-acre spaced wells. The alternate conversion of wells to inputs along property lines would protect correlative rights.

The study estimated a fresh-water supply of 25,200 bbl. daily would be required. The water supply could be obtained from wells drilled to 500 ft. Cost of the water-input facilities and pumping units for producing wells was estimated at $2,775,766. This also would include five water-injection plants built at present tank-battery sites.

The input rate would be calculated to permit pressure regulation and optimum recovery of oil at a rate of 143 bbl. daily per well. By transferring all allowables from the input wells, actual oil output per producing well could be hiked to 286 bbl. daily.

Hot water . . . Lewis estimated the best water-flood conditions would be obtained by using water at a temperature of 129 degrees. That also is the temperature of the reservoir.

Engineers for Lewis figured that the water would have to reach the input wells at a temperature of 90 degrees. It would warm up to 129 then by the time it reached the producing-sand face. Water taken from fresh-water sands has a temperature of 50 degrees. This drops to about 32 after filtering, storing, and moving to input wells.

So the problem of heating the water will arise. Lewis suggested five water plants for Areas A, B, and C with a total capacity of 30,200 bbl. and an input rate of 25,200 bbl. daily. At each station there would be two 1,000-bbl. galvanized tanks for surface water storage. Each would be equipped with 4,000,000 B.t.u. direct-type heaters.

Water would be heated to 100 degrees at the station. It would cool in going through the distribution system but would be heated again at the meter station by salt-bath heaters to 120 degrees. Temperature then would fall to 90 degrees when reaching input well.

The maxium input rate with cold water was estimated at 256 bbl. daily per well while that for warm water would be 360 bbl. Injection equilibrium would be attained at a reservoir pressure of 1,760 psi. and would stabilize at the 360-bbl. input.

Keep the gas . . . Operators were advised by Lewis not to make long-range commitments for the gas reserves of their holdings.

The report pointed out that heating the injected water will be necessary and also that gas injection, propane injection, or carbon dioxide injection may be feasible.

Thus all the gas reserves of the area may be required in the future operations.

No time for delay . . . Lewis declared the program should be launched full scale immediately.

He said a pilot program was unnecessary and impractical and predicted that water injection would result in recovery of the estimated primary reserves in 4½ years.

The study indicated the opportunity to start the water flood will exist for only 2 years. A delay will force a cut in input rates in the future in order to permit a reasonable balance between voidage and input capacity.

Lewis estimated the date for beginning flooding now is January 1, 1957. This would mean that the weighted average pressure of the reservoir in the area at that time would be 1,610 psi.—only 150 psi. less than desired injection equilibrium.

Economic life . . . Engineers estimated wells in the area presently will average 8.4 bbl. of oil daily over their productive life. Economic life of the field at this rate was figured at 15 years for Areas A, B, and C, and 10 years for D.

Future operating life after January 1, 1956, with gas injection was estimated at 10 years.

Total life of the water-flood project using cold water was put at about 42 years to 1998. Ultimate recovery should total 102,134,000 bbl. of oil and 48,652,000 M.c.f. of gas.

With warm water, the project should continue for 37 years, through 1993, with total recovery of 107,034,000 bbl. of oil and 52,341,000 M.c.f. gas.

Lewis reported preliminary tests with carbon dioxide injection indicated a 7.5 per cent increase in ultimate recovery over the warm water flood. Prospects for adding this process were believed favorable for further consideration.

Work starting up . . . The operators already have let contract to Brown & Root, Ltd., covering construction of pumping plants and burying and wrapping of lines for the project.

Work also has started on widening right-of-ways for flow lines. The operators have the required pipe on hand, and the project is scheduled to be in operation by the end of the year.

Trans-Canada Pipeline Loan Approved

- **Parliament's action ends 5-year battle to bring gas from western Canada to big eastern markets**
- **Construction to begin July 1 on 2,250-mile line with first deliveries due this fall in Winnipeg**

OTTAWA. — Trans-Canada pipeline has at last cleared the tremendous political and financial hurdles which for 5 years have thwarted its construction.

The long-awaited start will be made next month on the $378-million project which will bring Alberta gas to eastern Canada through the world's largest pipeline.

The breakthrough finally came last week after a bitter all-night session in the House of Commons. At 3:22 a.m. Wednesday, the $72-80 million loan was approved, providing 90 per cent of the cost of the western leg for Trans-Canada Pipe Lines, Ltd. The 574-mile, 34-in. segment will bring gas from the Alberta-Saskatchewan border to Winnipeg, the first market on the prairies.

Senate concurrence, virtually automatic, completed the victory for Prime Minister St. Laurent's Liberal government Thursday.

The Liberals used the closure gag rule limiting debate for the first time in 24 years to ram through the loan. The action precipitated the noisiest political storm that Canada has seen in a long time, and will carry over to the next election. The Conservatives wanted the line built by Canadian capital, which could not be found. The Socialists demanded a 100 per cent public venture. Both charged the Canadian people were footing the bill while U. S. oil and gas interests would reap the profits.

The government risked the unfavorable reaction in the interests of early construction of the line.

If no other obstacle rears its head —such as defeat of the plan to export gas to the U. S.—Trans-Canada can complete its 2,250-mile line which ultimately is to move 650,000,000 cu. ft. daily to markets from Alberta to Montreal. It will give producers an outlet for more than 4 trillion cubic feet of shut-in natural gas—one-fourth of Alberta's entire reserves.

Construction details . . . Trans-Canada expects to be delivering 21,000,000 cu. ft. daily to Winnipeg by December 1.

Target date for completion of the western section is October 31. There will be six spreads with 200 to 300 men working on each spread. Pipe-laying should move fast across the prairie country. A mile-a-day pace by each spread would get the job done in plenty of time.

Trans-Canada was ready to move the minute the loan went through. Engineering is complete, right-of-way obtained. Pipe is being rolled, and contractors are lined up.

If the western leg is completed on schedule, the line can be carried to Ontario next year. Completion of the 675-mile northern Ontario section, to be built by the federal and provincial governments and leased by Trans-Canada, will come next. The line could be delivering gas to Montreal in 1958.

Producers . . . Canadian producers will be the first to benefit since they control Bindloss field, located almost at the gate of Trans-Canada.

They will get 10½ cents per M.c.f. at the wellhead. The price delivered to Trans-Canada is 14½ cents.

Bindloss has sufficient gas to supply all requirements the first year. It is sweet and dry, ready for transmission, and field pressure alone will push the gas to Winnipeg.

Producers in Bindloss who will sell the first gas to Trans-Canada are Bailey Selburn Oil & Gas Co., Selbay Exploration, Ltd., Pathfinder Petroleums, Ltd., Highwood Development, Ltd., Alberta Pacific Consolidated Oils, Ltd., New Chamberlain Petroleums, Ltd., Canadian Export Gas, Ltd., Alminex, Ltd., Cabanga Development, Ltd., Ranvik Oils, Ltd., and Royal Canadian Oils, Ltd.

Three of the major producers who will benefit later are Canadian Gulf Oil Co., Hudson's Bay Oil & Gas Co., Ltd., and Canadian Delhi Oil, Ltd., all backers of Trans-Canada. Others with supply contracts are West Maygill Gas & Oil, Ltd., Great Sweet Grass Oils, Ltd., and Western Petroleum Leases, Ltd.

Trans-Canada will tap Pincher Creek, Cessford, Provost, Atlee-Buffalo, Kessler, Sibbald, Oyen, Princess, Nevis, Homeglen-Rimbey, Gilby, and other fields.

Markets . . . It will take 1,000,000,000 cu. ft. just to fill the line to Winnipeg before deliveries start.

And although the initial market is small, it may be tripled by the time the Alberta-Winnipeg line is completed this fall. Prospects are that such towns as Brandon, Portage, La Prairie, Rivers, and Minnedosa in Manitoba will jump at the chance for gas, now that the pipeline is out of the talking stage. Trans-Canada also passes just 2 miles south of Regina, Saskatchewan's capital.

Trade Minister C. D. Howe has announced that Trans-Canada has signed or has in prospect markets for 300,000,000 cu. ft. daily in Canada, mostly in the east. He says that would put the pipeline on a paying basis even without the U. S. Midwest market—which has been considered all along the key to private construction of the project. But there is disagreement on this point.

Import-export deal . . . Although Trans-Canada has taken its biggest stride forward, it is not out of the woods yet.

FPC refusal to approve the plan to import gas into the United States could seriously impair chances for private capital to complete the line.

One spokesman said it would mean an "agonizing reappraisal" of the whole project.

Tennessee Gas Transmission Co., one of the backers of Trans-Canada, is seeking FPC authority to buy 200,000,000 cu. ft. daily at Emerson, Man., south of Winnipeg, through an affiliate, Midwestern Gas Transmission Co. Midwestern would market a like amount from the Gulf Coast in the Chicago area and elsewhere along the 1,112-mile line from Emerson to Portland, Tenn. *(The Oil and Gas Journal, October 17, 1955, page 90).*

Canadian imports would be doubled later. T.G.T. in turn would deliver up to 90,000,000 cu. ft. daily to Trans-Canada at Niagara Falls to develop Toronto and Montreal markets until the Canadian line is completed. This flow would be reversed then with Canadian gas going to the metropolitan New York area.

If the Midwestern scheme is approved, it will be over the strong protests of coal interests and such entrenched Midwest pipelines as Northern Natural Gas Co. This firm, which tried to promote a similar deal, claims its old contract with Trans-Canada is still valid.

The National Coal Association last week asked the FPC to dismiss the Midwestern application. If this motion isn't granted, coal interests asked that hearings be suspended for at least 5 months to give time for preparation for cross-examination of witnesses.

FPC approval might not be the end

of the fight. Opponents show no indication of quitting, and could force a protracted legal battle lasting a year or more.

Loan provisions . . . The government loan must be repaid by March 31, 1957, at 5 per cent interest, or Trans-Canada must forfeit the line. The government will be able to buy the escrowed capital stock of the company.

The loan agreement is tied to the offer of a crown corporation to build the uneconomic northern Ontario section. If the loan isn't repaid, the Ontario and federal governments are relieved of their Ontario obligation.

Trans-Canada sponsors must divest themselves of 51 per cent of their stock for Canadian offering at the time of public financing. This will remove part of the objection of Canadian opponents —that the pipeline was 83 per cent controlled by Americans.

Trans-Canada backers . . . The structure of Trans-Canada has changed greatly since Clint Murchison's Canadian Delhi Oil first proposed the ambitious project.

The company was incorporated in March 1951. Three years later the Western Pipe Line Group, composed of Canadian businessmen, joined the Dallas independent in the venture.

Two of the biggest breaks for financing Trans-Canada came late last year and early this year. Tennessee Gas of Houston, operator of the world's largest natural-gas pipeline system, became a partner. Big producer backing was added with Canadian Gulf and Hudson's Bay, a subsidiary of Continental Oil Co., being taken into the company.

A reshuffling of stock ownership gave Canadian Delhi 24½ per cent interest, Western Pipe Lines 24½ per cent, and the other three big backers 17 per cent each. N. E. Tanner, president of Trans-Canada, said these holdings would be reduced by more than one-half when public financing is completed.

Tanner was formerly Alberta minister of mines, minerals, lands and forests, and president of Merrill Petroleums. Other key officers of Trans-Canada are C. S. Coates, executive president and general manager, former senior vice president of T.G.T.; and three vice presidents—A. P. Craig, former director of shipbuilding for the defense production department and vice president of Canadian Westinghouse; H. R. Milner; and F. A. Schultz.

Directors, besides these officers, are A. Deane Nesbitt, secretary and treasurer of Trans-Canada; Edward Asselin, Montreal; E. W. Bickle, Toronto; R. C. Brown, president of Hudson's Bay, Calgary; John R. Fell, New York City; E. D. Loughney, Calgary; M. W. MacPherson, Regina; Clint Murchison; J. K. McCausland, Montreal; Gordon P. Osler, Winnipeg; Gardiner Symonds, president of T.G.T., Houston; Jules R. Timmins, Montreal; and J. Ross Tolmie, Ottawa.

Gulf Boundary Fuss Rages On

WASHINGTON. — The Justice Department last week turned down a plan of Louisiana officials to freeze the offshore lease situation until the U. S. Supreme Court decides where the state boundary runs.

Atty. Gen. Herbert Brownell, instead, asked the court to act on his motion for an injunction against the state proceedings. Louisiana Atty. Gen. Jack P. F. Gremillion countered with a request that the court ignore the state suits.

Gremillion proposed late in May that both the state and the federal Government suspend leasing in the twilight zone between the 3-mile and 3-league limits until the high court decides which is the boundary.

Brownell told the court it is important that development of the Continental Shelf "continue without interruption during the period of litigation in this court, under an agreement of the parties to escrow receipts if possible, but that it continue in any event."

He made his statement in answer to a court demand that the department and the state present their views by June 4 on the department's motion to give the federal Government a free hand while the question of the state's boundary is in issue.

"The United States does not believe that the area can be allowed to lie idle without great damage to the public welfare and to lessees who have invested hundreds of millions," Brownell said.

Gremillion contended the matter is not one for the high court's consideration. The two suits are entirely separate, he said.

The state suits do not infringe on the power of the Supreme Court, Gremillion argued. The state court injunction which halted the May 15 sale of federal leases was a "personal action" against Interior Department officials and not against the United States, he said.

The federal suit to limit Louisiana to a gulf boundary 3 miles from the low-water mark will not be heard until the court meets for its 1956-57 term next October. The state's reply to the Government's complaint is due to be filed this month.

The department is trying to halt state court actions which might further cloud the issue. The Supreme Court is expected to act on its motion this week as it ends its current term.

FPC Decision Hit

Continental appeals ruling in sale to Montana-Dakota

WASHINGTON.—The Federal Power Commission was advised last week that another of its jurisdictional decisions has been appealed to the courts.

Continental Oil Co. has filed in the Fifth Circuit Court of Appeals at New Orleans for review of the FPC's assertion of jurisdiction over the sale of gas to Montana-Dakota Utilities Corp.

Continental's request for a ruling that the sale was not subject to FPC control was denied by the commission February 6. At the same time, FPC issued a certificate for the sale, for which Continental had applied to avoid penalties under the Natural Gas Act.

Continental is selling Montana-Dakota gas produced from three wells in the Cloverly-Morrison participating areas of the South Elk basin unit in Park County, Wyoming. The company operates the wells for itself and other leaseholders.

The ruling that the sale was subject to regulation followed a finding that Montana-Dakota was a natural-gas company operating in interstate commerce.

Lion's Strike Settled

EL DORADO, Ark.—Lion Oil Co.'s refinery resumed normal operations here late last week following settlement of a strike which had crippled the plant for 3 months. Supervisory personnel had returned the 27,500-bbl. daily plant to partial operations last month.

W. M. Carney, Lion plant manager, and Don McCullar, president of Local 381, International Union of Operating Engineers, announced the settlement and signing of a new contract last Thursday. Neither elaborated on details of the settlement.

Two other domestic refineries still remain closed by strikes. They are Cities Service Co.'s 55,000-bbl. East Chicago plant and Shell Oil Co.'s new 50,000-bbl. plant at Anacortes, Wash.

ASSEMBLY-LINE METHODS were used by the teams of officials and clerks who processed documents as . . .

Houston-Atlantic Deal Closed

One of oil industry's biggest cash payments made as Texas firm gets just under $200 million for oil, gas holdings

WILMINGTON, Del.—Atlantic Refining Co. last week completed the purchase of the oil and gas properties of Houston Oil Co. of Texas. The transaction involved one of the largest cash payments in the oil industry's recent history and certainly one of the most complicated deals.

Houston Oil stockholders will net just under $200 million for their properties. The sale of the company's timber and paper interests in Texas brought another $35 million.

Final papers were signed in the offices of the Corporation Trust Co. in Wilmington just 5 months from the day Houston Oil's directors decided to liquidate the company *(The Oil and Gas Journal, January 16, page 72; May 7, page 82, and May 21, page 140).*

Atlantic Refining estimated last week that 25,000 copies of deeds and other legal documents containing more than 2,000,000 pages have been prepared, printed, and processed by several hundred officials. Transfer of title to more than 6,000 separate properties were recorded in 155 counties in 10 states.

Terms . . . Under terms of the deal, Atlantic paid Houston Oil $73,500,000 in cash outright. Another $125,000,000 was paid by a group of investors headed by Chase Manhattan Bank of New York.

The larger sum is part of a production payment plan under which 85 per cent of the present oil and gas production of Houston Oil's properties will go to satisfy the production payments. Atlantic estimated it will take about 10 years to satisfy the payment.

Atlantic emphasized last week that this $125 million production payment is not a financial obligation of the purchasing oil company. Atlantic received a favorable tax ruling last month from the U. S. Internal Revenue Service that if the 15 per cent production retained by Atlantic is sufficient to cover operating costs, those costs can be deducted as expenses.

Any production developed in Houston Oil's undeveloped properties by Atlantic will not be subject to the production payment.

Out of business . . . The final move in Houston Oil's complete liquidation came the same day the final papers for the sale of the oil and gas interests to Atlantic were signed.

Houston Oil sold its holdings in East Texas Pulp & Paper Co. to Time, Inc., which already had a one-half interest in the concern. Houston Oil's timber subsidiary, Southwestern Settlement & Development Corp., was sold to the pulp and paper company.

Stockholders of Houston Oil received their first liquidation payment of $62 a share last week. Another payment of about $4 a share will be made within a few months.

Here's what Atlantic acquired in the deal:

. . . All crude and gas reserves remaining after the production payments. Atlantic thinks this will be about one-half of Houston Oil's present reserves. The proved reserves today are estimated at 77,500,000 net barrels of oil, crude condensate, and plant product reserves, and about 978 billion cubic feet of gas reserves.

. . . A total of 473 net oil and 133 net gas wells now producing on Houston Oil's properties.

. . . Almost 83,000 net acres of producing properties.

. . . About 877,000 acres of undeveloped properties, including 473,000 acres under lease and 404,000 net acres owned in fee.

. . . All Houston Oil's production operation assets.

. . . Houston Pipe Line Co., wholly owned subsidiary of Houston Oil. It operates about 761 miles of transmission lines and 408 miles of gathering and distributing lines in Texas. Capacity is 375,000 M.c.f. of gas daily.

Oil Congress Set

World Petroleum Congress meets in New York in 1959

THE Fifth World Petroleum Congress will be held in New York at the new Coliseum May 30-June 6, 1959.

Some 5,000 scientists and other representatives of the oil industry from 30 nations are expected. Delegates will discuss technical advances in all phases of the industry in around 200 papers to be presented. The latest equipment will be displayed at an international exposition commemorating the 100th anniversary of the discovery of oil at Titusville, Pa.

C. Eugene Davis, Kirkwood, Mo., consultant, has been named general secretary of the congress. He retired recently as a vice president of Shell Oil Co. Eger V. Murphree, president of Esso Research & Engineering Co., now on a year's leave as special assistant to the Secretary of Defense, is chairman of the congress' permanent council.

Murphree also is chairman of the general organizing committee. Members are F. S. Clulow, vice president in charge of manufacturing, Shell Oil Co.; H. W. Field, general manager, research and development, Atlantic Refining Co.; Jerry McAfee, vice president, Gulf Oil Corp.; John C. Zimmer, assistant manager, Socony Mobil Laboratories; E. B. McConnell, vice president, Standard Oil Co. (Ohio); H. B. Nichols, vice president and director, California-Texas Oil Co.; J. K. Roberts, general manager, research and development, Standard Oil Co. (Ind.); and W. C. Kinsolving, vice president, Sun Pipe Line Co.

Air Coolers Could Upset Fuel

U. S. motorists' yen for air conditioning may result in lower permissible butane content in tomorrow's gasoline

ATLANTIC CITY. — American motorists are taking a real fancy to air-conditioned cars. Especially in Texas. If the present trend toward cool driving comfort continues, refiners are going to have to keep an eye on the front-end volatility of their gasoline.

This all adds up to possible limits on Reid vapor pressure and the permissible butane content in future gasoline. The combination of adding new devices like power steering to engine compartments, and the lowering of hood lines dictated by the stylists, is already raising under-hood temperatures appreciably.

When air conditioners are installed, the temperature control problem is compounded. The condensers they require add large amounts of heat to the engine and interfere with the cooling system.

These points were raised last week by M. R. Morrow of Humble Oil & Refining Co. He stated that the effects of air conditioners on fuel-volatility requirements are of immediate concern in Texas. To date, about one-third of all such units have been sold in Texas.

Sales are burgeoning and it won't be long before other areas will have to consider the problem. The U. S. history of air-conditioned car sales, and the forecast look like this:

AIR-CONDITIONED CARS

	In thousands		Per cent cars air-conditioned	
Year	For year	Total	All cars	New cars
1951	2	2		
1952	5	7		0.1
1953	20	27	0.1	0.3
1954	57	84	0.2	1.0
1955	176	260	0.5	2.5
1956	300	560	1.1	5.0
1957	450	1,010	1.9	8.0
1958	700	1,710	3.1	12.0
1959	1,000	2,710	4.8	17.0
1960	1,400	4,110	7.0	23.0
1961	2,000	6,110	10.1	33.0

About 60,000 air-conditioned cars were believed sold in Texas last year, representing about one-third of all cars so equipped. This concentration in Humble's marketing area prompted the company to take a look at what might be happening to gasoline volatility limits.

Humble experiment . . . The company obtained 12 cars including at least one Ford, Chevrolet, Plymouth, Oldsmobile, Buick, Cadillac and Chrysler. The cars were not modified except to place a drain cock on the fuel-drain outlet of the gasoline tank.

They were operated at least for 20 miles at 60 m.p.h., parked and idled for 3 minutes, then the engine was stopped for 20 minutes to heat soak. Any hesitation or engine roughness was recorded as vapor lock. Indications of vapor lock occurred during acceleration in all cases, but were mild in most. The fuels used were made up from a typical premium gasoline base stock without butane, and butane was added to vary volatility.

The fuel-volatility limits were then determined. Of the 12 cars tested, three were checked before and after installing the air-conditioning units. The R.v.p. limits dropped 1.3 lb. on the average when the units were installed but not operated, and dropped an additional 0.6 R.v.p. when the units were turned on. For all cars, the R.v.p. limits dropped an average of 0.7 R.v.p. when the units were turned on.

Humble emphasized that this study was of a survey type and was not intended to provide complete data on all cars and all types of air conditioners. Manufacturers of cars and air conditioners are trying to compensate for these undesirable effects. But the Humble survey shows that for the present at least, the limiting factor is present. The company presented the paper in hopes that others would continue the studies, and that equipment would be improved to permit cars to handle higher-volatility fuels.

With hurricanes offshore . . .

. . . Crews to Help Spot Storms

NEW ORLEANS.—Drilling crews on offshore rigs have been enlisted in the Weather Bureau's hurricane-forecasting service.

During this year's hurricane season, just getting under way, weather observations will be recorded at 6-hour intervals by crewmen on at least three rigs working off the coast of Louisiana. The data will be transmitted by radio to the New Orleans weather station, where it will be used in forecasting and tracing storms.

Stephen Lichtblau, meteorologist in charge of the New Orleans Weather Bureau, said all oil operators working in the gulf had offered to participate in the service.

Tentatively selected as offshore observation bases are three rigs operated by Phillips Petroleum Co., The California Co., and Pure Oil Co. The installations are about 68 miles southwest of Morgan City, 68 miles southeast of Lake Charles, and 65 miles southeast of Cameron.

Negotiations are said to be under way for establishing at least one base on a platform off the coast of Texas.

Crew members participating in the forecasting service will be given brief training by Weather Bureau personnel. They will take pressure, temperature, and wind readings from instruments to be supplied by the Weather Bureau. Reports normally will be made to the New Orleans weather station every 6 hours except during emergencies when they will be more frequent.

Lichtblau said the offshore observatories will be of great help in detecting storms which develop near shore and sneak inland with little warning.

In addition to the offshore stationary bases, three ships sailing the Gulf of Mexico will help provide data needed in forecasting storms. Weather Bureau personnel will be stationed on the vessels.

Crude Line Expansion Due

FINDLAY, Ohio. — Ohio Oil Co. will boost capacity of its Martinsville, Ill., to Lima, Ohio, crude trunk line by 20,000 bbl. this winter. Present capacity is 195,000 bbl.

The 224-mile line will get three 2,500-hp. pumping units in Indiana. One will be installed at Elwood. The other two will be located at Roachdale to replace a diesel unit now operating at Jamestown, Ind.

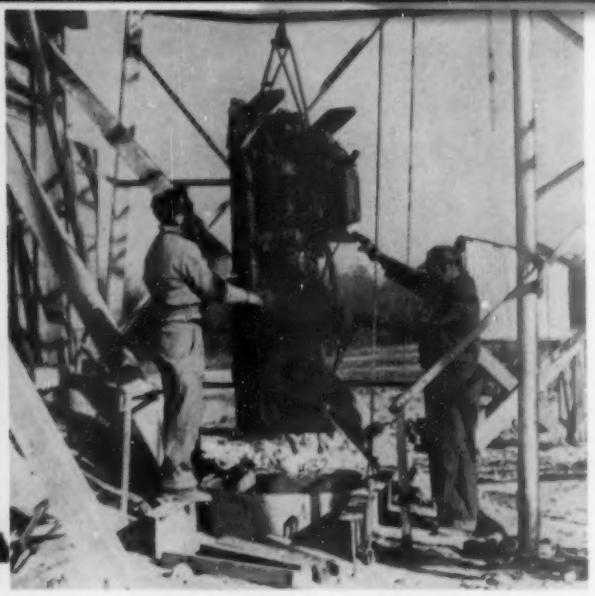
Ohio Oil will do its own work. The new facilities should be operating by December 1.

Kermac Buys Another Refinery

OKLAHOMA CITY.—Kerr-McGee Oil Industries, Inc., has completed purchase of the 20,000-bbl. daily Cushing refinery which it has leased for 13 months from General American Oil Co., Dallas. Sale price was around $3,500,000.

Kerr-McGee also has a 17,000-bbl. daily refinery at Wynnewood. It also bought the old Johnson Oil Refining Co. plant at Cleveland, Okla., but is operating only the 1,840-bbl. Platformer, using feed stock from Cushing.

Casing for main shaft is lowered away . . .



followed by disassembled diesel engine . . .

and track from dozer which was . . .

reassembled on the floor of the reservoir for . . .

Bulldozing 300 Ft. Under the Surface

TUSCALOOSA, Ala.—Seven-ton bulldozers are carving out a big L.P.G. storage reservoir 300 ft. under the ground—and they got there through a 42-in. shaft.

The cavern is being mined in Selma chalk at Demopolis, some 60 miles southwest of here. It will have a capacity of 6 million gallons. Completion is set for July. Tuloma Gas Products Co. and Sinclair Oil & Gas Co. each have 50 per cent interest. Tuloma will serve as the operator.

But about those big diesels being crammed down a 42-in. hole. They—two of them—were lowered piecemeal after being dismantled by Fenix & Scisson, Inc., general contractors of

Tulsa. This is believed to be a "first" for such an operation.

The dozers were reassembled on the floor of the reservoir with little trouble. The ingenious idea has resulted in these benefits:

... Dollar savings. The dozers replace an expensive network of rails which would carry rocker shovels and buckets where the dozers now go. They also eliminate the need for a special crew to continuously lay rails and perform maintenance on them. Only tracks needed are three short sections, 40 to 65 ft. long. The dozers operate cheaper than rocker shovels, which have been relegated to a minor role.

... Speedier work. The dozers are cutting down on time needed to complete the project. They move faster than rocker shovels and buckets, do more work.

... Versatility. They are also being used as portable platforms for wall trimming, replacing need for ladders. This is another example of speeding up operations.

To increase their efficiency still further, the dozers were equipped with rippers—heavy steel teeth—which drop down from the rear. As the dozers make their rounds, the rippers tear up the flooring behind them.

After half a dozen trips through a tunnel, they have lowered the entire length of floor another foot. This adds up to a lot of "free" footage.

Basic job of the dozers is to clear out the waste rock which piles up with the growing network of tunnels. Previously, rocker shovels and buckets had to make the entire trip from central shaft to the end of each tunnel and back again.

Now, the slower, more costly shovel never has to move more than 65 ft. from the main shaft. The dozers do the rest, picking up the waste from drift heads, carrying it to the ends of the tracks, and dumping it in piles. The rocker shovels then load the rock into buckets for the trip to the surface.

To prevent exhaust fumes from fouling the underground air, two 12-in. ventilation shafts were sunk and the diesels were rigged with scrubbers. Mining inspectors tested the air and found it safe. They couldn't even get a dangerous reading right at the tip of the exhausts.

The Tuloma-Sinclair project has still another unusual feature. It's the first time an underground storage unit of this type has been mined in chalk, which is impervious and requires no sealant. Chalk is widespread over the United States, so others in the industry will be watching this one closely. It might be the start of a new era in low-cost underground storage.

Jersey Invades Midwest Market

MILWAUKEE. — Standard Oil Co. (N. J.) quickly completed purchase of Pate Oil Co. here last week giving the world's largest oil company a toehold in the rich Midwest marketing area.

Pate stockholders approved the stock exchange deal which reportedly involved a consideration exceeding $2 million. Jersey Standard marketing experts took over immediately.

R. R. McCoy, who has been Standard's assistant marketing coordinator in New York, became the new president of Pate. McCoy succeeds William R. Pate, who is retiring.

Other officers named were E. R. Smith, executive vice president and director,, and M. B. Denning, manager of supply and transportation and director. Smith and Denning also are veteran marketing officials with Jersey Standard.

McCoy announced that Norman H. Ott and James E. Dornoff, Pate vice presidents, will remain as officers and directors of the new company. John H. Van Dyke of the Pate organization will be a director and secretary-treasurer.

The acquisition gives Jersey Standard 140 service stations and two bulk plants within a 50-mile radius of Milwaukee. Current volume of Pate is about 50 million gallons per year with about 33 million gallons representing gasoline. This gallonage figures to about 3,250 bbl. daily.

Pate officials aren't saying what plans they have for expansion or new sources of supply. By moving in top-bracket marketing officials, Jersey Standard obviously has big plans for the new outlets.

Phillips Petroleum Co. holds a contract to supply Pate with products. It runs until October. After that, Pate officials say they haven't settled on plans. They may get supplies through exchange agreements. They could bring in products from Imperial Oil, Ltd., Jersey Standard's Canadian affiliate. Or they might move Esso products up the Mississippi River from Baton Rouge.

However, Jersey still reportedly is interested in acquiring International Refineries, Inc., which operates a 12,000-bbl. refinery at Wrenshall, Minn. That would solve the supply problem at least for a time. But perhaps not for long because reports still persist that Jersey Standard also is dealing to enter Illinois in a big way.

Processing BRIEFS

JACKSON, Miss.—Owners of Southland Co. have bought Delta Refining Co., which operated a 6,000-bbl. refinery at Memphis, Tenn. Plans have been announced for doubling capacity of the plant.

E. Constantin, Jr., president of Southland, heads the group making the purchase. Price was not announced. Southland has two refineries in Mississippi, one at Sandersville and the other at Yazoo City. The company has started construction of 40 new service stations.

CORPUS CHRISTI.—A 10,500-bbl. Unifining-Platforming unit will be built at Delhi-Taylor Oil Corp.'s 40,000-bbl. daily refinery here. Construction is to start August 1. Completion is due early in 1957.

MORGANTOWN, W. Va. — Olin Mathieson Chemical Corp. last week started up its experimental unit for production of synthesis gas by partial oxidation of coal. This is the first unit of its kind ever built. It employs the Texaco Development Co.'s partial oxidation process which will produce synthesis gas from heavy fuel oil and natural gas as well. The Morgantown unit is capable of producing enough synthesis gas to make 80 tons per day of ammonia or equivalent methanol.

CASPER, Wyo.—The Texas Co. has started up a new 4,800-bbl. Platformer at its 17,000-bbl. daily Casper refinery. Fluor Corp. designed, engineered, and built the unit. The reformer is the tenth added by Texaco under a $72-million expansion program. The company's reforming capacity totals 105,500 bbl.

SMITHS BLUFF, Tex.—Pure Oil Co.'s new 15,000-bbl. per day Ultraforming unit is slated for completion during the third quarter. Also building at the major Gulf Coast refinery is a 20,000-bbl. per day hydrodesulfurization unit to process naphthas and middle distillates.

LONG BEACH.—Hancock Chemical Co. expects to begin operating two new 65-ton sulfur-recovery plants in Wilmington, Calif., by June 15. The $1,500,000 project will get hydrogen sulfide from three major refineries nearby and convert it into raw sulfur. Ralph M. Parsons Co. is contractor. Hancock already operates a 120-ton plant in Wilmington.

New trend in fuel testing . . .

. . . Road Octane Ratings Now Big News

ATLANTIC CITY.—The United States refiner is having trouble enough keeping up with the octane race today. But that isn't the end of his trouble.

As research octane ratings climb, the octane appetites of his customers' cars also change. The higher-compression engines now coming off the assembly lines tend to downgrade the research octane ratings of motor fuel more than older models did.

The upshot is that road ratings are fast becoming important news. They represent the realistic measurement of antiknock quality of a motor fuel. And they do it where it counts—in an automobile on the road.

Complications arise, however. Different automobile engines road-rate fuels differently. And commercial gasolines of the same research octane rating but with varying composition, also show different road ratings.

Testing gasolines in car fleets is a costly and time-consuming procedure. Hence some better means of anticipating octane appetites or road ratings from conventional laboratory tests is sorely needed.

How Road Octanes Look Across the Nation

LABORATORY VS. ROAD OCTANE RATINGS
(Du Pont National Gasoline Survey)

Cities—	No. samples	(1) Research	(2) Motor	(3) Modified Uniontown	(1-2) Sensitivity	(1-3) Road octane depreciation
Premium grade:						
New York	7	96.7	86.8	94.6	9.9	2.1
Philadelphia	4	97.1	86.8	94.7	10.3	2.4
Cleveland-Detroit	6	95.2	85.4	93.6	9.8	1.6
Chicago	8	95.0	86.3	93.9	8.7	1.1
Tulsa-Oklahoma City	6	94.4	86.3	93.8	8.1	0.6
Houston	6	97.7	87.3	95.8	10.4	1.9
Denver	4	91.6	83.7	90.8	7.9	0.8
San Francisco	4	96.2	87.1	94.5	9.1	1.7
Los Angeles	5	96.4	85.5	93.6	10.9	2.8
Average		95.6	86.1	93.9	9.5	1.7
Regular grade:						
New York	7	91.5	84.8	89.9	6.7	1.6
Philadelphia	4	91.7	84.2	89.6	7.5	2.1
Cleveland-Detroit	5	89.4	82.6	87.7	6.8	1.7
Chicago	7	88.9	82.3	86.8	6.6	2.1
Tulsa-Oklahoma City	6	86.7	83.0	85.4	3.7	1.3
Houston	6	89.0	82.7	87.7	6.3	1.3
Denver	4	85.1	80.7	83.6	4.4	1.5
San Francisco	4	87.1	82.4	85.9	4.7	1.2
Los Angeles	5	87.1	70.6	85.5	7.5	1.6
Average		88.5	82.5	86.9	6.0	1.6

Some new ideas . . . Research departments in both the auto and refining industries are working on this need.

Some new suggestions were presented last week at the annual summer meeting of the Society of Automotive Engineers here. They urged that researchers:

. . . Derive better correlations between established laboratory tests and road octane requirements.

. . . Adopt improved laboratory tests which will give a better fix on road octanes.

New laboratory test? An approach to obtaining road octane ratings from a laboratory engine was presented by E. M. Barber, H. I. Wilson, and T. H. Randall of The Texas Co.'s Beacon Laboratories.

They devised a single-cylinder power section mounted on the C.F.R. crankcase. This engine modification gives a general duplication of the performance of multicylinder automotive engines, they reported.

Texaco's laboratory results were compared with road ratings obtained in a variety of 1947-1952 and 1955 cars. Compression ratios of these models ranged from 6.5 to 9.0. Further road tests were made with modified engines in the 9, 10, and 11 compression ratio range.

Commercial fuels of a wide variety were tested on the road and in the laboratory. Also checked were special blends comprising extreme variations in content of straightrun, thermal, catalytic, polymer, reformate and alkylate gasoline components. They ranged from 68 to 105 research-octane number.

Texaco's study showed that the new single-cylinder laboratory engine rated these fuels in general agreement with the road-octane ratings. A maximum spread of three octane numbers was obtained. This represents a definite improvement over the research and motor methods for laboratory rating. They showed deviations from road ratings of as much as 10 units.

Correlation with existing tests . . . Another approach in evaluating road ratings of fuels was presented by C. J. Domke, N. D. Esau, D. S. Gray, and H. S. Talliaferro of the research department, Standard Oil Co. (Ind.).

This method uses conventional research and motor methods. It consists of a method for correlating research octane, sensitivity, and hydrocarbon composition to octane ratings obtained in multicylinder engines in dynamometer tests.

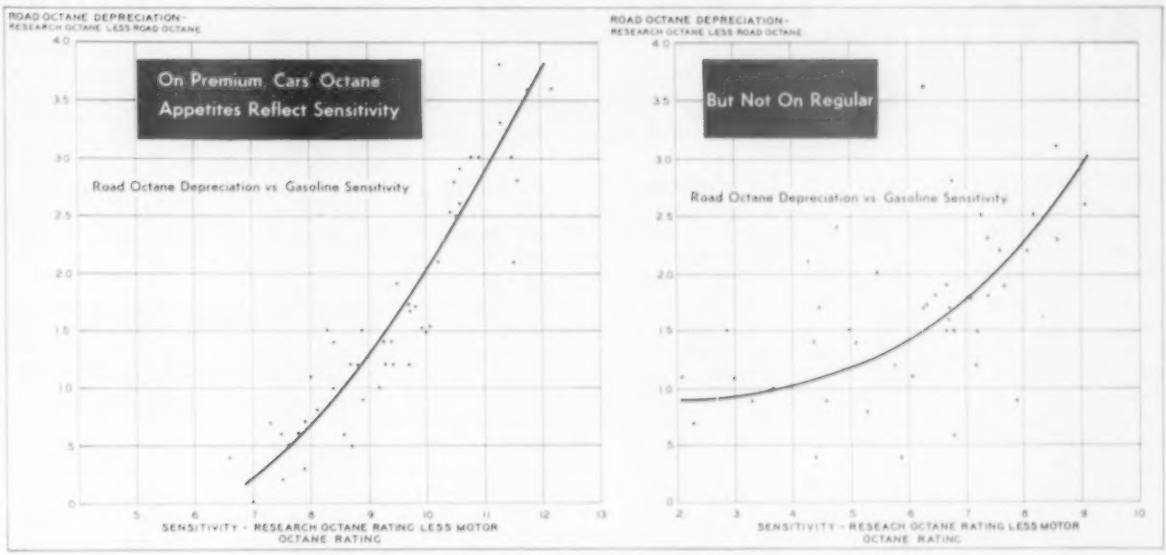
A number of fuels of varying composition were knock-rated in the laboratory. They also were grouped by sensitivity—the spread between research and motor octane ratings. The simulated road depreciation, or the spread between research octane and requirements on the chassis dynamometer, was then obtained for fuels in each sensitivity class.

The team then developed an overall relation to determine what research octane and sensitivity characteristics a particular fuel should have to compare favorably with a standardized primary reference fuel.

They found, for example, that an engine requiring a 95-octane reference fuel would be satisfied by an olefinic gasoline with a research rating of 95.5 and a sensitivity of 4. But if an olefinic fuel with a sensitivity of 12 were substituted, it would have to rate 101.5 research octane to satisfy the engine.

The same engine, they found, would be satisfied by an aromatic fuel with sensitivity of 4 and research octane of 96.5. But an aromatic fuel of 12 sensitivity would need to have a research rating of 98.

The authors warned that road ratings on the highway will be needed to confirm some of their findings ob-


ROAD OCTANE DEPRECIATION - RESEARCH OCTANE LESS ROAD OCTANE
On Premium Cars Octane Appetites Reflect Sensitivity
Road Octane Depreciation vs. Gasoline Sensitivity
SENSITIVITY - RESEACH OCTANE RATING LESS MOTOR OCTANE RATING
ROAD OCTANE DEPRECIATION - RESEARCH OCTANE LESS ROAD OCTANE
But Not On Regular
Road Octane Depreciation vs. Gasoline Sensitivity
SENSITIVITY - RESEACH OCTANE RATING LESS MOTOR OCTANE RATING

tained with chassis dynamometers in the laboratory. They feel that the indicated "bonus" derived from aromatic over olefinic stocks needs further demonstration.

There's an equation . . . Good correlations can be obtained between road octane numbers and research and motor octane ratings for conventionally made, full-volatility motor gasolines.

E. E. Corner of Esso Research & Engineering Co. revealed this development. He stressed the belief that motor octane number is becoming much more important than it was a number of years ago. The reason: Automatic transmissions and changes in engine design have increased the engine speed at which knock occurs.

Corner, in his paper entitled "Octanes—From Laboratory to Road," declared that depreciation obtained by subtracting road from research octane numbers is a poor measure of the relative effects of research and motor octane numbers on road antiknock performance.

Corner proposed a mathematical equation based on relationships existing among the three octane ratings. The values used in the determination are essentially constant in any given car at any given speed or knock. Esso also has found this about its correlation equations: They are about the same for current and experimental high compression-ratio engines at a given speed as in other cars of about 7:1 compression ratio.

Different cars road-rate the same fuels differently. But good correlations with laboratory-octane ratings are obtained in cars showing high, low, and average severity.

Look at road ratings . . . The general growth of activity in fleet tests by oil companies has contributed much new information on just how road ratings compare with laboratory findings. But reported results have been spotty.

What is believed to be the first overall look at national road ratings has resulted from a program conducted by the Petroleum Division, E. I. du Pont de Nemours & Co., Inc.

The Du Pont results, released just last week, give a general comparative picture of road, research and motor octane ratings on 48 samples of regular-grade gasoline and 50 samples of premium grade. The samples were taken in nine marketing areas over the country.

Within the limits of the test program, the results are considered representative of how the average car on the road rates the many brands of gasoline of both grades.

Du Pont used six cars for its road ratings. The 1955 Chevrolet and Plymouth, Synchromesh transmission, and the 1956 Ford with Fordomatic transmission were used to test regular-grade samples. For premium grade, the 1955 Buick with Dynaflow transmission, the 1956 Cadillac with Hydra-Matic transmission, and the 1956 Lincoln Capri with Turbo-Drive transmission were used. All models had V-8 engines.

The three ratings given these gasoline samples are shown as averages by cities in the table. The corresponding research-motor and research-road octane spreads are shown as sensitivity and road-octane depreciation.

The survey shows some important points. Sensitivity of the higher antiknock premium samples is much greater than that of the regular grade. This reflects the higher aromatic content of the former. But road-octane depreciation shows a similar average, with a greater scattering of values in the premium grade. Both of these fuel characteristics vary geographically, with the variation in aromatic content arising from catalytic-reforming operations.

The relationship between sensitivity and road-octane depreciation shows a fairly good correlation on premium-grade samples. The 50 plotted samples show relatively little scattering, reflecting the fairly uniform practice of blending reformates plus alkylate in some cases, to attain the high-octane ratings required.

The relationship between sensitivity and road-octane depreciation for the 48 regular grade samples is less precise. This reflects the very wide range of fuel components which are put together today to make this grade. A general trend line for premium grade is seen, but the values it shows cannot be used with much accuracy in predicting road octane from sensitivity alone. A similar trend for regular grade would have little use in correlating road octane depreciation from laboratory ratings.

Scale Slightly Off Key

A scale on isooctane-plus-TEL in the chart illustrating methods of numbering octanes above 100 carried in the June 4 issue of The Oil and Gas Journal, page 68, is in error. The correlation correctly ranges from isooctane plus 0.5 cc. at about 115 AN-PN to 6 cc. at about 162 AN-PN.

Tax Writeoffs Attacked

Joint economic committee warns amortization program may cause industry unfairness which could hurt later growth

WASHINGTON.—Congress was urged last week to take a new look at the emergency tax amortization program.

The Korean War plan to speed the expansion of essential industries is costing the Government $880,000,000 in tax revenues this year, a staff report of the joint economic committee charged.

But it is also giving the Government dangerous control over the allocation and use of resources, the report asserted. This may result in imbalances in basic industry which later may slow or halt general economic growth, it was warned.

More than 21,000 quick writeoff certificates have been issued since November 1950. They cover an investment of over $38,000,000,000, of which nearly $23,000,000,000 can be written off in 5 years.

Oil has big share . . . Certificates for expansion of oil and gas production, refining, and transportation capacity total approximately $4,000,000,000. They included up to the end of last year some $2,715,000,000 for refining and $1,263,000,000 for pipelines.

"The benefits of special amortization invest the recipient with relatively greater command over available resources than companies not so favored. Because of the discretionary control over the distribution of the benefits, the usual market tests for assuring maximum effectiveness in use of resources may be, in part, avoided," Grover W. Ensley, executive director, said in the committee report.

There is also a possible element of unfairness of tax-burden distribution, Ensley said. Firms given certificates may obtain substantial financial benefits not generally available to competitors using noncertified facilities.

Certificates issued during the first quarter of this year covered the highest investment recorded for any 3-month period since mid-1952. And there are indications this high level will continue as a result of new goals announced by the Office of Defense Mobilization last fall.

The domestic oil goal which called for refining capacity of 8,750,000 bbl. a day by the start of this year was increased to 9,000,000 bbl. by next January 1 under the new program. The alkylate goal was upped by 25,000 bbl. daily to provide 55,000 bbl. a day.

Effect of writeoffs . . . The writing off of new investment over 5 years instead of over the ordinary useful life of a plant reduces a company's taxable income during that period, it was explained. After 5 years, of course, taxable income is greater than it would have been had ordinary depreciation allowances been in effect.

This postponement has been called an interest-free loan by the Government. In the event tax rates are lower after the 5-year amortization period, the "loan" will not be fully repaid. But if rates rise, of course, the "loaned" tax funds may be more than repaid.

Full impact of the program on taxes will be felt in the 1958-60 period, when the loss to the treasury will be $1,100,000,000 a year, the report said. Thereafter, collections will begin to increase as the new plants come fully out from under the umbrella of quick amortization.

The Treasury will lose some $4,464,000,000 in taxes over the 1951-60 period. In the following 5 years it will recoup $1,705,000,000 of that amount. How much of the remaining $2,800,000,000 will be recovered is problematical, the staff declared.

B.A. Expands Plant

40,000 bbl. to be added to Clarkson refinery capacity

TORONTO. — British American Oil Co., Ltd., has let a $5½-million contract to Canadian Kellogg Co., Ltd., to build new crude-processing facilities at the firm's Clarkson refinery. The units will add 40,000 bbl. of crude to the plant's present 21,500-bbl. capacity.

Construction is scheduled to begin immediately. The new units are in addition to a 10,000-bbl. catalytic reformer now being built at Clarkson, 23 miles west of Toronto. The expansion is part of British American's $56-million capital budget program for 1956.

Crude for the new processing facilities will be supplied by the extension of the Interprovincial pipeline from Sarnia to the Clarkson area *(The Oil and Gas Journal, May 14, page 101)*. The line is scheduled for completion in the fall of 1957. It will permit greater flexibility of operations and guarantee Clarkson refinery a year-round supply of Canadian crude oil. Extensive tank storage is now needed during the winter months.

The Clarkson refinery was built in 1943. It produces quality gasolines, fuel oils, lubricants, greases, asphalts, and specialty products for the fast-growing Ontario market. Crude throughput was raised 17 per cent last year. Output of the grease plant was increased 45 per cent.

FPC Ruling Sticks

Review denied, producers still have to file prices

WASHINGTON.—The Federal Power Commission has won the first court test of its controversial "174 order" requiring independent producers to file prices and secure sales certificates.

The U. S. Supreme Court denied a petition by Gulf Oil Corp. for review of a Circuit Court decision holding the order had been issued legally.

It was challenged by a number of companies on the charge it was issued without prior notice or hearing, in violation of the administrative-procedures law. The Gulf case was the first to be acted upon by the high court.

Gulf also questioned the FPC's authority to freeze prices as of June 7, 1954, without hearings, and to hold contract price adjustment clauses to be changes in rates subject to its review.

The Supreme Court did not pass on any of the issues presented. Its action was an order denying review.

While the court settled the question of procedure, it left the way open for consideration of issues arising out of the order itself. One such issue has been presented by Union Producing Co., which seeks nullification of the order because it covers wellhead sales. The court may announce whether it will review that case before it adjourns this week.

Socal Ammonia Plant Nears

RICHMOND, Calif.—Standard Oil Co. of California's 300-ton per day synthetic ammonia plant now under construction here is scheduled to go into operation September 1.

The plant, which is being built by M. W. Kellogg Co., will use the Kellogg steam methane reforming process, with natural and refinery gases as charge stock.

The reforming step is expected to result in 25 to 35 per cent savings in compressor horsepower. Another de-

sign feature is a special quench-type reactor to allow optimum temperature control, resulting in improved yields and lower operating costs.

Near-isothermal conditions in the reactor is expected to prolong catalyst life, lower maintenance costs, and permit higher conversion per pass.

Most of the ammonia produced will be used in the manufacture of complete fertilizers.

Bill Will Aid Refinery Deal

WASHINGTON. — Legislation paving the way for a refinery on the Tulalip Indian Reservation in Washington state was passed by Congress last week.

The bill would permit the tribal council to buy some 300 individual tracts so the land could be sold as a block to Richfield Oil Corp. The company reportedly plans to build a $50,000,000 refinery on the 700 acres it wants to acquire on the reservation *(The Oil and Gas Journal, May 28, page 100)*.

The legislation was necessary because most of the 18,000 acres in the reservation is broken into very small holdings as a result of the Indians' complex heirship system.

Tribal leaders are anxious to sell the land as a step toward the economic improvement of the tribe. Congress moved quickly to carry out their plan. The bill was introduced May 24. It was passed by the Senate 11 days later and by the House the following day. The measure now goes to the White House for action by the President.

Crude System Planned

CALGARY. — Rangeland Pipeline Co., Ltd., subsidiary of Hudson's Bay Oil & Gas Co., Ltd., plans to build a crude gathering system and trunk line in west-central Alberta. It will start operating this fall.

Rangeland will lay 17 miles of 6-in. and 16 miles of 4-in. from the west end of Joffre field to connect West Joffre, Bentley, Gilby, and West Gilby. Rangeland, a new company, will build 10½ miles of 12-in. from Gilby Junction to Rimbey. Texaco Exploration Co. will extend its present facilities to pick up the oil at Rimbey and move it to Edmonton. Construction will include 48 miles of 16-in. from Edmonton to Bonnie Glen and a 48-mile, 8-in. loop.

Rangeland's project will cost $1,275,000 and Texaco's $1,100,000. Initial throughput of the Rangeland system will be 3,300 bbl. daily, to be expanded later to 10,000 bbl. Texaco's capacity is 11,400 bbl. daily and is to be upped to 92,200 bbl.

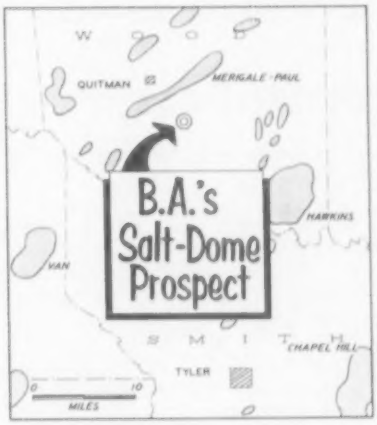
Thick Pay Logged

● British-American test on East Texas salt dome may have 85-ft. pay

DALLAS.—A wildcat on a nonproducing salt dome in East Texas has logged oil-saturated sands in the Woodbine plus shows in the Eagle Ford. Reports indicate a possible pay section of 85 ft.

British-American Oil Producing Co. revealed these interesting facts last week in releasing information on its 1 Bessie Wisenhunt. It's an exploratory test on the Hainesville salt dome in southern Wood County. Location of the well is in the Wesley Tollett Survey, 6 miles northeast of Mineola.

Woodbine prospect . . . The derrick floor elevation at 1 Wisenhunt is 370 ft. The well went into the salt at 1,796



ft. and drilled out of the overhang at 5,690 ft. into Pecan Gap chalk.

Top of the Eagle Ford was 8,777 ft., which was reported to have had several sand stringers with oil shows. A sub-Clarksville sand (member of the Eagle Ford) with high-gravity oil shows was logged at 9,052-63 ft.

The Woodbine was topped at 9,215 ft. In logging the well to 9,775 ft., operators reported broken sand to 9,350 ft. with a net possible pay section of 85 ft.

Testing ahead . . . Drill-stem tests had not been made when this information was released.

Decision to set casing was based on shows in the Eagle Ford. Drilling continued below 10,400 ft., on an amended contract to around 12,000 ft. to test the Paluxy.

British-American holds 6,300 acres around the well. Lease maps show Ryan Consolidated Petroleum Corp. and Standard Oil Co. of Texas hold nearby acreage.

Another discovery reported . . . A wildcat on the flank of the Bethel salt dome in Anderson County is reported to have recovered 1,000 ft. of oil on drill-stem test.

The well is The Texas Co. 2 E. C. Williams, located 7 miles northwest of Tennessee Colony townsite. Drilling continued below 5,675 ft. following the test, and unconfirmed reports are that the structure is very similar to the British-American well on the Hainesville salt dome.

Location of the Texaco wildcat is in J. N. Acosta Survey, A-1, with The Texas Co. controlling all offset acreage. Drill site is a southeast offset to the firm's 1 Williams which was a failure in the Woodbine around 5,636 ft.

Montana Sale Scheduled

HELENA, Mont.—The next sale of state-owned oil and gas leases in Montana will be July 16 at the State Land Board offices here.

The date was set at a special meeting of the four-member board composed of Gov. J. Hugo Aronson, Secretary of State S. C. Arnold, Public Instruction Supt. Mary Condon, and Atty. Gen. Arnold H. Olsen. Aronson and Arnold are Republicans while Miss Condon and Olsen are Democrats. The political division set tempers boiling at both the special meeting and at an earlier regular meeting during which Aronson and Miss Condon exchanged accusations.

At the regular board meeting the governor and secretary of state refused to second Miss Condon's motion for a July lease auction. Aronson claimed the motion was motivated by politics. Only 35 applications were on file then.

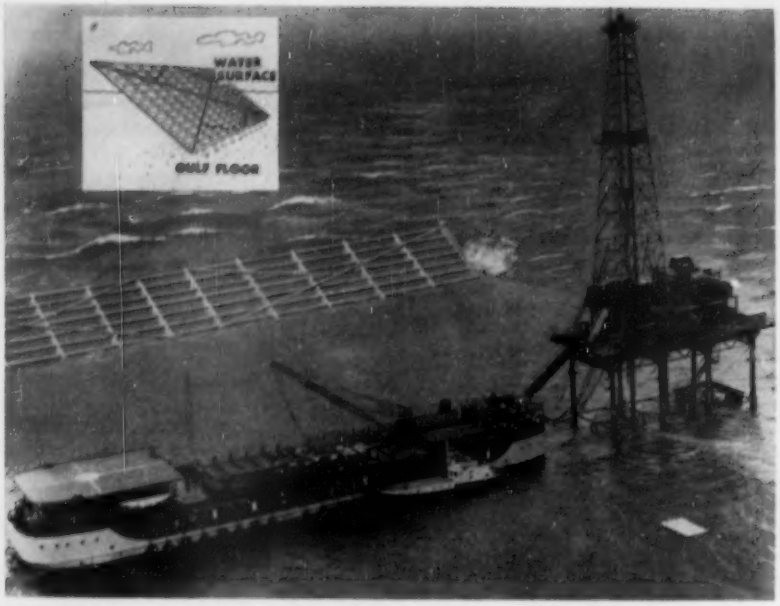
At the special meeting, called by the governor after receipt of nearly 100 lease applications, Miss Condon refused to second Arnold's motion for a sale until Aronson apologized for his earlier accusation.

Gas Line Almost Complete

SALT LAKE CITY.—Pacific Northwest Pipeline Corp. plans to begin deliveries in most sections by August 1 from its nearly completed natural-gas line extending from the San Juan basin to Sumas, Wash.

The 1,466-mile line is complete except for a 30-mile section near Umatilla, Ore. It will move gas to the Pacific Northwest from San Juan basin and will purchase Canadian gas from Westcoast Transmission Co., Ltd.

The company reports it has signed contracts for markets totaling 511,000,000 cu. ft. of gas per day. Initial daily capacity of the line will be 645,000,000 cu. ft. daily.



AN ARTIST'S CONCEPTION of how the floatable breakwater would work. It means . . .

A Steel Curtain for Drillers

HOUSTON.—A floatable breakwater has been designed to calm rough waters which sometimes interfere with offshore oil operations.

Known as the "Sea Raft," the structure can be towed to location and one edge sunk to form a seawall. With modifications, it can be used in water as much as 10 ft. in depth.

Framework is designed to be built of 30-in. pipe with cross bracing. Pipe would be spaced about 4 to 5 ft. apart. Normally, a unit would be about 220 ft. long and 100 ft. wide.

How it works . . . At location, one side of the unit may be sunk by water flooding and anchored by 10-ft. extension probes spaced 20 ft. apart.

A. L. Smith, president of Sea Raft Corp., which designed the unit, says weight of the structure is sufficient to force these probes into the gulf bottom.

In water 30 to 40 ft. deep, the structure would lean at an angle of about 30°, as shown in the artist's conception. Framework above the water would be closed with steel plate, forming a wall about 40 ft. wide and 220 ft. long. The wall section would extend 8 to 12 ft. above the surface of the water. The center of gravity is controllable by the amount of water used in the structure.

The designer says tests have shown the structure would remain almost stationary in normal waves. With extremely high wave swells, the breakwater will rise and fall because of its buoyancy together with the higher water level, Smith says.

It can be moved . . . The structure may be refloated by raising the sunken portion with air pressure applied from a tug through a 2-in. hose. The refloating operation would require an estimated 3 hours, after which the structure may be towed to another location.

Smith, who also is president of Petroleum Instrument Co., Houston, recently formed Sea Raft Corp. to specialize in design of offshore structures. The company also has designed rafts to be used as mats supporting drilling and production platforms.

Correction

The Journal in its May 28 issue erroneously reported that the price of alloy sucker rods last July increased 15 per cent following the basic steel increase. Actually it was barely 5 per cent. The error resulted from an inadvertent comparison of two different types of alloy rods.

Here is what the table on page 83 should have carried for alloy rods, per 100 ft.:

	June 1955	July 1955	Per cent increase
⅝-in.	$41.42	$43.45	4.90
¾-in.	52.43	55.05	5.00
⅞-in.	67.02	70.35	4.97
1-in.	86.61	90.95	5.01

Big Tracts Offered

Blocks in Texas University leasing call for deep tests

AUSTIN.—Two of the largest drilling blocks ever offered by the University of Texas will be up for lease at the scheduled June 26 lease auction.

They make up a portion of the total 57,200 acres which will be offered by the university at that sale.

Both tracts are in Pecos County to the north of the Puckett field multipay area. Tract 116 includes 13 parcels of land in Block 23 comprising 3,840 acres. Tract 122 totals 3,680 acres in 12 parcels in Block 24.

Each requires the drilling of probably the deepest wildcat ever demanded of a bidder for a university lease—a test to 16,000 ft., to the Ellenburger if that pay is found shallower than 16,000 ft., or to commercial production at a lesser depth.

The Ellenburger formation in the area generally is found between 13,000 and 15,000 ft.

Along with the two big tracts, the university is offering seven other smaller drilling blocks.

Four of these are in Crockett County and call for wildcats to depths of from 2,200 to 10,200 ft. Two require tests to the Ellenburger, the other two to the San Andres.

Three other blocks will be offered for lease in Reagan, Ward, and Winkler counties. Tract 67 in Reagan takes in roughly 1,280 acres and requires a 3,150-ft. test to the San Andres. The Ward block of 2,563 acres (Tract 141) and the Winkler block of 2,563 acres (Tract 142) both call for Delaware sand tests to 5,000 ft.

Dual-Tax Plan Approved

WASHINGTON.—A dual system for tax treatment of first-year rentals on oil and gas leases was announced by the Internal Revenue Service last week.

Operators holding noncompetitive government leases may treat their first-year rentals as nondepletable, deductible expenditures. But for holders of private, nongovernmental leases such payments will continue as capital investments recoverable only through depletion.

The IRS ruling is in line with court decisions in two cases which it originally had intended to contest. The courts held that first-year rentals were ordinary and necessary expenses paid or incurred for the production or collection of income for the maintenance of property held for income.

San Joaquin Outlet

Union Oil will run crude line to refinery at Oleum

LOS ANGELES.—Union Oil Co. of California will begin construction soon on a 225-mile crude pipeline from southern San Joaquin Valley to its 45,000-bbl. refinery at Oleum on San Francisco Bay.

The 16-in. line will have an initial capacity of 75,000 bbl. daily. The addition of booster stations will increase capacity to 110,000 bbl. The line will include a 12-in. segment from Union's Junction pump station to Coalinga. From Coalinga, a 16-in. line will carry crude and unfinished products, via Los Banos, to the Oleum refinery.

Union now transports San Joaquin Valley crude from Junction to its tanker-loading facility at Avila through two 8-in. lines. The crude is then transported to either Oleum or Los Angeles by tankers.

When the new 225-mile Junction-to-Oleum pipeline is completed late next year, one of the 8-in. Junction-to-Avila lines will transport valley crude to Union's 5,000-bbl. refinery at Santa Maria and 19,000-bbl. coker at Arroyo Grande.

The other 8-in. line will then be used to carry cracking stock and distillates from the refinery and coker back to Junction, where it will be put into the new line for transport to Oleum. These partially processed fuels will be batched in the new line with crude.

The Junction-to-Oleum line will release at least one tanker from duty on the present Avila-to-Oleum run.

B.-A. to Drill 17,000 Ft.

TULSA.—British-American Oil Producing Co. will drill the second deep test in Knox field, Grady County, Oklahoma, near the state's deepest producer. The 1 Reed will go to 17,000 ft. to test the Arbuckle.

The new wildcat in the Bradley district is 1 mile north of the 2 Harrison discovery that opened Oklahoma's deepest production February 14 at 15,250-15,310 ft. Production is from the third Bromide sand. The well flowed 138 bbl. of distillate in 10½ hours with 2,000 M.c.f. of gas per day on final completion.

British-American controls 25 per cent of the unit test, Magnolia Petroleum Co. 43.75 per cent, Ohio Oil Co. 25 per cent, Sunray Mid-Continent Oil Co. 3.125 per cent, and Edwin L. Cox 3.125 per cent. Big Chief Drilling Co. of Oklahoma, which drilled the record deep producer, also is contractor on this hole.

watching WASHINGTON

... with Bertram F. Linz

New bill is aimed at consent decrees . . .

REP. JAMES ROOSEVELT of California wants to take some of the "consent" out of consent decrees.

These arrangements, reached privately between the Justice Department and companies charged with antitrust violations, don't protect small business enough, Roosevelt says.

They save time and money for both sides, and lighten the burden on the courts. But the judge who has to pass on a consent decree doesn't have a record before him to help him decide whether it is in the public interest. And since it is a compromise, Roosevelt believes, defendants sometimes get easier terms than they would if the case went to trial.

Roosevelt has a bill to hold up consent decrees for 30 days after they are filed in court.

Government versus private industry . . .

THERE'S been a lot of talk over the past few years about taking the Government out of business. But few realize just how deeply entrenched Government is in commercial and industrial operations.

The first census of federal activities competing with private business has just been made by the Budget Bureau. It shows an amazing 19,771 operations for production or services for the Government's own use.

Even this figure does not include the nonmanufacturing agencies of the Defense Department, the oil "business" on the naval petroleum reserves, small activities of a number of agencies which produce less than $25,000 a year and have capital assets of less than $5,000, activities for public service such as power projects, or activities which provide products or service for federal civilian or military personnel.

How much money has been sunk in these operations has never been figured. It may never be. But the nearly 20,000 operations counted by the Budget Bureau represents an investment of $11,900,000,000 and 266,000 employes.

With few exceptions, these activities are producing goods or services which can be procured from private enterprise through ordinary business channels, the bureau says.

No station monopolies for new roads . . .

THERE will be no service station monopolies along the roads to be built under the new highway program.

Both House and Senate have written bans into the bill, which is now in conference. The clauses differ and will have to be compromised. But the result will be a rule that no service stations shall be built on the right-of-ways of the interstate highway system.

A number of other points also have to be worked out in conference. But there is no difference over the taxes to be imposed to pay for the new roads. The motor fuels levy will go up 1 cent and stay there for years.

Pressure builds up against imports . . .

DOMESTIC producers don't like the planned new formula for regulating oil imports. Neither does the coal industry.

Spokesmen for the coal producers are demanding immediate action to curb imports. And they want it based on last year's recommendations by the cabinet fuels committee, not on some new equation.

The formula laid out by Mobilization Director Arthur S. Flemming is unrealistic, the coal men say. It ignores 75 per cent of the imports. The result is to approve Middle East imports only slightly below the present high level, which is far above the cabinet committee's view of what is proper.

Gas Pinch Spreading

Transmission lines short of new supplies in Gulf Coast; producers reportedly find local markets more profitable

HOUSTON.—A shortage of new supplies of natural gas for interstate sale already is being felt by transmission companies operating out of the Gulf Coast area.

Distributing companies in the East will soon feel the pinch also.

That is the report of Wayne J. Johnson, president of Natural Gas Service Co. Johnson resigned recently as manager of the gas-supply department of Trunkline Gas Co. to establish his new concern. It will work primarily to develop new intrastate markets for independent gas producers. But it will also advise them on dealing with pipelines and the Federal Power Commission when selling interstate.

Since veto of the Harris-Fulbright bill, Johnson says, interstate pipelines in South Texas and Louisiana have run into trouble. They have been unable to purchase enough new supplies to offset normal declines in their reserves.

The only new reserves they have been able to connect are small ones. These were obtained when the producer faced a drainage condition, a financial obligation to sell, or had no other market.

Local buyers gain . . . At the same time, Johnson says, purchasers of gas for consumption within the state of production are getting the gas.

They are paying from 1 cent to 5 cents per M.c.f. above prices offered producers by interstate lines. Such prices for interstate movement have been blocked by the FPC on grounds they are not shown to be just.

According to Johnson, industries that use gas in large quantities are showing increased interest in locating plants near the source of gas supply. This indicates the intrastate markets for gas in the Gulf Coast area will soon absorb most of the new gas reserves which otherwise would be sold for interstate transmission.

There is little hope for new legislation removing FPC regulation of gas producers until consumers and distribution companies realize that supplies for interstate sale are actually drying up. Johnson predicts that the pinch will be felt this winter but will become acute before satisfactory legislation can be enacted.

Big question . . . As long as prospects remain as good as they now are for developing local markets, Johnson says, the attitude of those owning uncommitted gas reserves is this:

"Why sell gas in interstate commerce? You can never be assured under existing procedures of FPC that you will receive the prices contained in your contract. And they are arrived at only by long hours of arms-length bargaining and in tough competition with other interested purchasers.

If FPC would call a conference of interstate pipelines, Johnson believes, it would soon discover a majority of them already are having great difficulty maintaining their supply position. The situation is rapidly getting worse.

In the absence of legislation, Johnson suggests, the condition could be improved if the FPC would:

. . . Stop treating producers as guilty before trial by making them bear the burden of proof.

. . . Lay down some standards for determining when a producer's price is proper.

. . . Employ staff members who understand the producing end of the gas business.

. . . Establish field offices in producing areas with authority to issue temporary certificates and make preliminary decisions. This would end much of the delay in referring everything to Washington.

. . . Realize potential markets in areas of large gas reserves are more attractive to producers than interstate sales under the present FPC procedures.

Oklahoma Well Has Famous Namesake

OKLAHOMA CITY.—Oklahoma has a second-generation 1 Mary Sudik. The present-day well with a famous name is shown above. It's a good producer by current standards but a far cry from the antics of its namesake, "the Wild Mary."

The original 1 Mary Sudik was one of the largest oil wells ever completed in Oklahoma and brought renown far and wide in April 1930 to the South Oklahoma City field. The well came in with an initial flow of 27,950 bbl. per day and 150,000 M.c.f. of gas from the Wilcox at 6,445 ft. It blew wild, and wind carried the oil and gas spray for miles. The flush production was put in ponds, creeks, and hastily built reservoirs of mud. Houses and offices near the well were evacuated until it was controlled.

The next 1 Mary Sudik was completed peacefully nearly 26 years later on land owned in Cleveland County by heirs of the original Mary Sudik. It was a step out 1 mile northeast from production in the Short Junction field. Initial production was at the rate of 1,008 bbl. of 37°-gravity crude per day on ½-in. choke. Production was from the Bois d'Arc at 7,928-71 ft. and total depth of 8,022 ft.

San Pedro Terminal stores Natural Gasoline . . .

Two 141½-ft. diam. Hortonspheroids at the Warren Petroleum Corporation San Pedro terminal.

in Hortonspheroids . . .

Natural gasoline, at the Warren Petroleum Corporation's San Pedro, Cal., terminal, is stored in the two 141½-ft. diam. Hortonspheroids® shown above, to prevent excessive evaporation loss. The structures, designed for 15 lbs. per sq. in. working pressure will allow no loss to occur as long as the internal pressure does not exceed the pressure relief valve settings.

CB&I builds Hortonspheroids in standard capacities to 120,000 bbls. and in the smaller capacities for pressure to 100 lbs. per sq. in. Our nearest office will be happy to supply further information.

Office of the terminal with the Hortonspheroids in the background.

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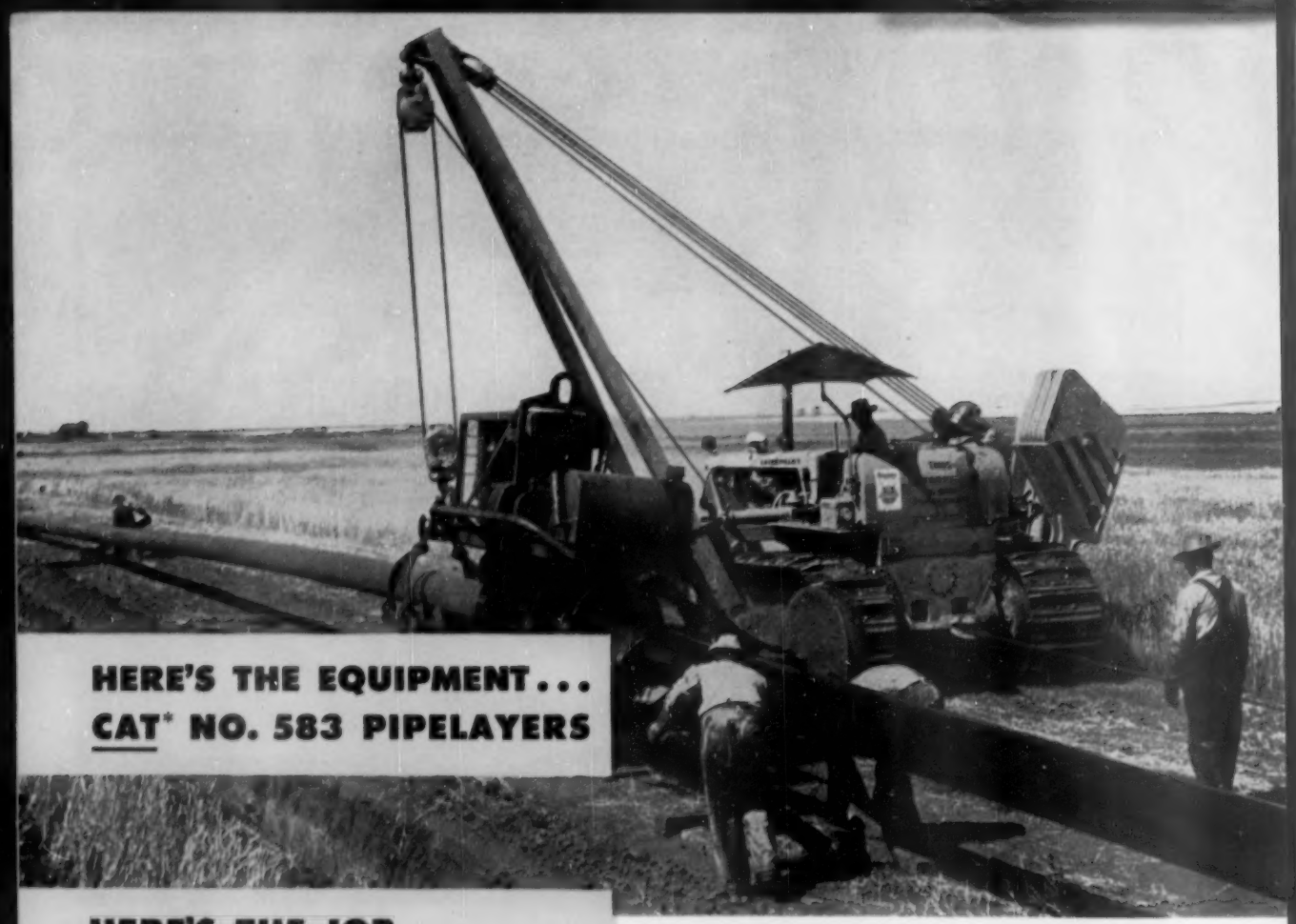

HERE'S THE EQUIPMENT...
CAT* NO. 583 PIPELAYERS

HERE'S THE JOB THEY'RE DOING

The No. 583s—highest capacity pipelayers in history—are working on a 219-mile, 14" natural gas line in northern Saskatchewan for Majestic Contractors Ltd. of Edmonton. Pipe is being laid at the rate of four miles a day in sandy loam and clay in terrain that varies from steep hills to flat prairie. The No. 583s were part of an extensive all-Caterpillar spread purchased by Majestic last May. It includes thirteen D7s, two D6s, one D4, twelve D318 Diesel Engines for clams and hoes and two D339s for ditchers.

HERE'S THE COMMENT THEY HAVE CAUSED

Odis Hare, General Superintendent—"We are well pleased with all our Caterpillar-built equipment, particularly the No. 583 Pipelayers. They are evenly balanced and the 21-inch clearance is a real asset in rough terrain. We have had very little down time. In 30 years of pipelining, I've used plenty of big yellow equipment. So when we bought all new equipment, naturally we chose Caterpillar."

Matt Rachal, Superintendent of Equipment—"I have been in pipelining and heavy construction for 25 years. Caterpillar-built equipment is the most rugged and dependable in the toughest going, particularly when we have to meet rigid work schedules. We are well pleased with the parts service from Caterpillar Dealers everywhere."

Ed Lawson, Purchasing Agent—"We sure depend on Caterpillar service to keep us on the job and on schedule at all times. I have purchased parts all over the United States and Canada and our parts service here is among the best we have experienced."

Now see for yourself the cost-cutting production of the new No. 583 on *your* job. And profit yourself from the quality parts and service that back up these big units. Call your nearby Caterpillar Dealer for a demonstration.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

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**NAME THE DATE...
YOUR DEALER
WILL DEMONSTRATE**

Cardium Test Hits

Amerada, Cal-Standard bring in well at 192 bbl.

CALGARY.—The Cardium sand of Alberta fame is back in the exploratory news this week.

Amerada Petroleum Corp. and California Standard Co. have opened a new Cardium oil pool 4½ miles northwest of Texaco Exploration Co. oil wells in Alhambra-Cardium field.

The 6-6 Willisden Green discovery was completed for an initial potential of 192 bbl. of oil per day. Pay sand was topped at 6,061 ft. Perforations were at 6,063-72 ft. During the 4-hour production test, the well made oil at 192 bbl. per day on 20/64-in. choke.

Willisden Green is 40 miles northwest of Red Deer. Hi-Tower Drilling Co., Ltd., drilled the well.

The reservation rights bought by Amerada at the May 24 sale are located between Alhambra-Cardium field and Cardium producers at Rocky Mountain House. Texaco opened Alhambra field while wells in Rocky Mountain House were drilled by New Superior Oils of Canada, Ltd., and associates. The wells at Alhambra are on rights purchased by Texaco at the Crown Reserve sale on January 26, 1954, for cash bonus of $2,100,125. Texaco's reservation covers 87,680 acres in Townships 41 and 42, Ranges 5 and 6w5. Amerada's reservation is in Townships 21 and 42, Range 7w5.

Leasing Rules Clarified

WASHINGTON. — Deposit regulations for lessees of Indian lands were clarified by the Bureau of Indian Affairs last week.

Successful bidders will be required to deposit 25 per cent of the bonus bid and complete the lease within 30 days under the new rules.

In the past lessees generally have been required to deposit 20 per cent and complete their payment in 20 days. But there has been no uniformity of practice, the bureau explained.

In addition to paying the bonus in full, the first year's rental and the lessee's share of advertising costs also must be paid within 30 days.

Field Gets Outlet

Gulf plans 33-mile, 8-in. crude line at Citronelle

CITRONELLE, Ala. — Fast-growing Citronelle field in southwestern Alabama soon will have its first pipeline outlet.

Gulf Oil Corp. last week announced plans to lay an 8-in. line to move crude from the field to Mobile. The line will be about 33 miles long and will connect with Gulf's dock facilities at Mobile.

Construction is to start in the near future, and the line is scheduled to go into operation before the end of summer. Gulf also will lay a field gathering system. At each lease equipment will be installed to pump oil directly to the Mobile terminal.

The system will have an estimated capacity of 28,000 bbl. per day, allowing for anticipated growth in production from the Alabama field.

Citronelle, discovered last summer, now has 20 wells either producing or nearing completion. Production totals more than 3,500 bbl. daily, and output is expected to double by year's end.

One of the major operators in the Citronelle area, Gulf is now trucking the field's crude production to the Mobile terminal.

From the terminal to North Mobile, the new line will parallel Gulf's 14-in. crude carrier serving fields in the Laurel and Baxterville areas of southeastern Mississippi. Pipe for the new system will be recovered from one of Gulf's old lines, then coated, wrapped, and cathodically protected.

West Texas Wells Sold

MIDLAND. — South States Oil & Gas Co., San Antonio, revealed last week that it is paying $3,100,000 for an unspecified interest in production in Farmer San Andres pool of Crockett County, West Texas. Seller is V-T Drilling Co., Odessa.

South States will get an interest in 22 oil producers, each with a daily allowable of 55 bbl., on 1,000 acres of leases. There are also 16 proved locations and 10 semiproved locations on the acreage.

South States will pay only $100,000 in cash. The remaining $3,000,000 will come out of 80 per cent of working-interest production.

Industry BRIEFS

BILLINGS.—Montana has a new drilling-depth record. The 1 Northern Pacific of Mountain States Drilling Co. and Phillips Petroleum Co. in Carbon County is coring at 13,270 ft. Last reported top was 12,620 ft. in the Chugwater. Old record was 13,134 ft. held by Sun Oil Co. at 1 Beagle Land & Livestock Co. in Richland County in the Williston basin.

DALLAS.—A new company, Sovereign Oil Corp., has been formed here. The company has production in Kansas and Colorado, and will maintain offices at Independence, Kans., and Colorado Springs, Colo., as well as at Dallas.

Edwin W. Hayes, Colorado Springs, is president of the firm. Roger Evans, Jr., is vice president and general manager, and Roger Evans, Sr., is treasurer. Both are of Dallas.

LETHBRIDGE, Alta. — A 46-mile pipeline from Etzikom gas field, southeast of here, to Medicine Hat will be built by New British Dominion Oil Co. Construction is to start June 22. The line is due to be completed by mid-August. Cost is estimated at $1,800,000. Customers of the line include a new fertilizer plant of Northwest Nitro Chemicals which will produce 140,000 tons a year of ammonium nitrate and ammonium phosphate.

BATON ROUGE.—Dow Chemical Co. plans to start construction soon on a plant near here to produce caustic soda, chlorine, and several organic chemicals. The company has exercised its option to purchase a 1,700-acre plant site along the Mississippi River between Baton Rouge and Plaquemine, La. Cost of the plant will exceed $20,000,000.

LINCOLN, Neb.—W&M Oil Co. of Lincoln and Wyoming Oil Co. of Delaware are merging.

Keith Walker, president of the Lincoln firm, says the merger has been voted by directors of both firms and waits only formal approval by stockholders. Wyoming Oil Co. will be the surviving firm with headquarters in Lincoln. W&M has holdings in Colorado, Wyoming and Utah.

HOUSTON.—A 2-year study of air pollution in the Houston area will be conducted by Southwest Research Institute, San Antonio, at a cost of $160,000. The Houston Chamber of Commerce contracted for the survey, which will begin in the near future.

U. S. Encroachment Hit

Compact Commission meeting warned that state regulatory rights are jeopardized by ever-expanding federal powers

DALLAS.—State regulation of oil and gas production is in great jeopardy of encroachment by the federal Government, it was agreed at the summer meeting of the Interstate Oil Compact Commission.

The attack on expansion of federal powers was led off by Gov. Allan Shivers of Texas in his welcoming address.

"The Compact Commission," Shivers said, "is fulfilling its destiny as a symbol of states' rights—but it is more than a symbol. It is a demonstration of the states' willingness and ability to meet their responsibilities in the field of oil and gas conservation.

"Unless those who believe are willing to act as well as to talk, this is indeed the sundown hour for the states. Next comes the twilight zone of federal predominance in which the state governments would exist by sufferance of Washington."

Shivers referred particularly to the request of the Department of Justice for an appropriation of $762,000 to hire 110 people to investigate the Compact Commission. The real target, he said, is not the compact itself but the actions of the states in using their sovereign powers to regulate oil and gas conservation. He saw the proposed investigation as a forerunner of federal control of the industry.

Another step in this direction was the Supreme Court decision in the Phillips case which gave the Federal Power Commission control over natural-gas production, Shivers said. He then launched into a review of a long list of other Supreme Court decisions which, he said, have the effect of amending the Constitution to extend federal authority and take away rights which the states intended to reserve.

The same theme was followed by Gov. John F. Simms of New Mexico in his report as chairman of the compact commission.

Industry on defensive . . . The veto of the Harris-Fulbright bill, he said, was a clear warning to the oil industry that it is on the defensive against federal regulation. He added:

"By this time we should be free from the illusion that we can expect consideration. I purposely didn't say 'special consideration'—just 'consideration.' In Washington the term 'oil business' seems to be anathema. It is fashionable in some very high Washington circles to regard the oil and gas industry with intense and self-righteous disapproval.

"Proposed regulations by the FPC following veto of the Harris-Fulbright bill have made it more than ever apparent that there is continuing and growing conflict between the regulatory powers and activities of state agencies, and the authority which FPC is undertaking to exercise.

"Somewhere in this continuing struggle the line must be drawn. It is the duty of the official states of the Interstate Oil Compact Commission to consider—and to consider very carefully—the growing peril to the basic police powers of states to regulate the development and production of oil and gas."

Simms also attacked the proposed investigation of the compact as an attempt to get federal control of the industry. He particularly criticized the statement of Assistant Attorney General Barnes that in this investigation "we are pioneering in the supervision of state regulatory bodies" as a tipoff that the real objective is control rather than a factual study.

GOV. JOHN F. SIMMS
"In Washington . . . oil . . . seems to be anathema."

Imports attacked . . . In line with these keynotes, the commission adopted resolutions asking the federal Government to take action on oil imports and gas regulation to assist the states in carrying out their programs of control of conservation.

The imports resolution declared that excessive supplies of oil from abroad cause physical waste of oil, lead to premature abandonment of producing wells, and hamper development of secondary-recovery methods.

The gas resolution declared that federal control of the industry will conflict with state conservation regulations and will lead to destruction of state conservation programs. Necessary controls over the industry at the state level, the resolution asserted, can and will enable the industry to furnish supplies of gas in the public interest.

New FPC member nominated . . .

. . . Seaton Gets Interior Post

WASHINGTON.—Fred A. Seaton of Nebraska was confirmed by the Senate last week as Secretary of the Interior and a Wyoming state judge, Arthur Kline, was named to the Federal Power Commission.

Kline will succeed Claude L. Draper, whose term expires June 22. Draper asked President Eisenhower last March not to reappoint him.

Seaton earlier received the unanimous approval of the Senate interior committee after a 90-minute hearing at which he was questioned regarding his stand on Interior policies which have been under attack.

He told the committee he is not familiar with the laws governing oil development on the wildlife refuges. But he said he would feel free to change any department policies he felt were not in the public interest.

The hassle over wildlife refuge leasing was the last of a series of controversies in which Douglas McKay, who gave up his cabinet post April 15 to run for the Senate from Oregon, was involved during his 3 years in office.

Draper is retiring from the FPC after 37 years of public service in regulatory work. For 11 years a member of the Wyoming state board of equalization and its public service commission, he was named to the FPC by President Hoover in December 1930.

The new Secretary of Interior is a Nebraska newspaper publisher who has been attached to the White House staff during the Eisenhower administration. He also served 1 year in the Senate, filling a seat left vacant by the death of Sen. Kenneth S. Wherry.

they asked for a

422,200 CUBIC FOOT "REFRIGERATOR"

Six terminals at 5 key market locations with over 12,000,000 barrels capacity: PORT OF NEW YORK (Carteret, N. J.) • PORT OF NEW ORLEANS (Good Hope, La.) CHICAGO, ILLINOIS (Bedford Park) • PORT OF HOUSTON (Galena Park and Pasadena, Texas) • CORPUS CHRISTI, TEXAS

General American Built it!

When a major oil company needed storage for styrene, they came to General American for help. Their problem was this: unless styrene is kept cold the inhibitor evaporates and the product polymerizes.

General American Tank Storage Terminal experts tackled the problem and came up with the answer —insulated tanks equipped with refrigeration units and insulated piping.

If you have need for specially-designed tanks for storing "ticklish" chemicals, General American can build them for you. Leased facilities at any of the six "key market" terminals give you the privacy, safety, service and flexibility of your own terminal—*without capital investment on your part.*

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Venezuela Area Opened

Final bids delivered on exploitation tracts which total 110,000 hectares in the highly prolific Maracaibo area

VENEZUELA is ready to grant its first new oil concessions in 11 years.

Sealed bids on 11 exploitation concessions of 10,000 hectares (24,710 acres) each in the Lake Maracaibo area were submitted in Caracas Saturday morning. Companies will be advised of concession awards later.

Although the acreage offered is unproven, it is among the most prized in Venezuela, being located in one of the world's greatest producing areas.

It runs from the delta of the Catatumbo River, which empties into the southwest edge of Lake Maracaibo, north and eastward until it adjoins some acreage held by Creole Petroleum Corp. and Cia. Shell de Venezuela, in the middle of the lake. Some of the area offered also is near Mene Grande Oil Co. concessions in the east side and other blocks are north of the Maracaibo bar in the Tablazo area.

The submerged tracts will be in water ranging from a few feet deep near the delta up to 90 ft. in the middle of the lake.

Concessions will go to the highest bidder, and bonuses are certain to be big. The government has set a minimum price tag of $485.70 per acre (4,000 bolivares per hectare). Some tracts are expected to bring much more. Venezuela stands to net at least $132 million from the offering and probably more.

Shell is known to have developed prolific Eocene production on concessions adjoined by the newly offered acreage. Much of the area has been shot by reflection seismograph, and competition was unusually hot.

Who's bidding . . . Ten companies were understood to have been invited to make the final bids.

The government would accept bids for no less than 10,000 hectares per application. Thus, with the minimum price set, bidding would start at 40,000,000 bolivares, or $12,000,000 per concession.

Bidders included both the big established operators in Venezuela and newcomers as well. Some of the established operators were reported to have offered joint bids for the high-priced tracts.

The names of the companies seeking the acreage have not been announced. But the most likely bidders are considered to be Mene Grande (Gulf), Creole Petroleum Corp. (Jersey Standard), Shell, Socony Mobil Oil Co. of Venezuela, Cities Service Co., Richfield Oil Corp., Phillips Petroleum Co., Texas Petroleum Co., Sinclair Oil & Refining Co., Superior Oil Co. of California, Richfield Exploration Co. (Standard of California), and Murmac Oil Co. de Venezuela, controlled by Clint Murchison, Dallas independent who already has Venezuelan production through Talon Petroleum, C.A.

Later offerings . . . Opening of the new lake territory to exploitation climaxes several delays since the government invited bids more than a year and a half ago.

This leasing may be only the beginning. A successful sale in the lake could lead to opening other areas.

The government is eager to offer new concessions for more than one reason. It wants first of all to increase revenue from oil, which now accounts for 80 per cent of its income. Higher-gravity crude also is sought, since more than half its production is 25° or less from the Lake Maracaibo basin of Western Venezuela.

Production, although rising, comes from decreasing acreage as operators give up half their tracts when they turn to development. (This will not be the case in the latest offering because the concessions are exploitation, not exploration).

The established companies, like Creole, Mene Grande, Shell, and others, would like to expand their operations. Those who failed to get in on the ground floor are very anxious to get a foothold in the world's second largest oil-producing country which still has a lot of easy oil to find.

Venezuela produces 2,392,000 bbl. daily from around 100 fields scattered over 5,871,168 hectares of concessions. This is only one-sixth of the sedimentary basin area of Venezuela. Oil companies last year applied for permission to explore 27,452,340 hectares for information on which to base future bids. Seismograph, gravity, surface geology, and other work was being carried out on all 11,190,206 hectares during 1955.

Several operators, besides the ones reported bidding for the lake acreage, are interested in getting into Venezuela.

Among the American companies who are looking for chances to establish or increase their foreign production are the Conorada group (Amerada Petroleum Corp., Continental Oil Co. and Ohio Oil Co.), Pure Oil Co., Sohio Petroleum Co., Sun Oil Co., Tidewater Oil Co., Signal Oil & Gas Co., and Southern California Petroleum Corp.

Two Big Refineries Planned in Panama

PANAMA appears destined to become a major refining area in record time.

Two new refineries are planned for the Central American republic with a combined capacity of 125,000 bbl. daily.

John M. Shaheen, New York investor who heads Panama Refining & Petrochemical Co., Inc., said last week he expects work on his company's 55,000-bbl. daily refinery to start "late this fall."

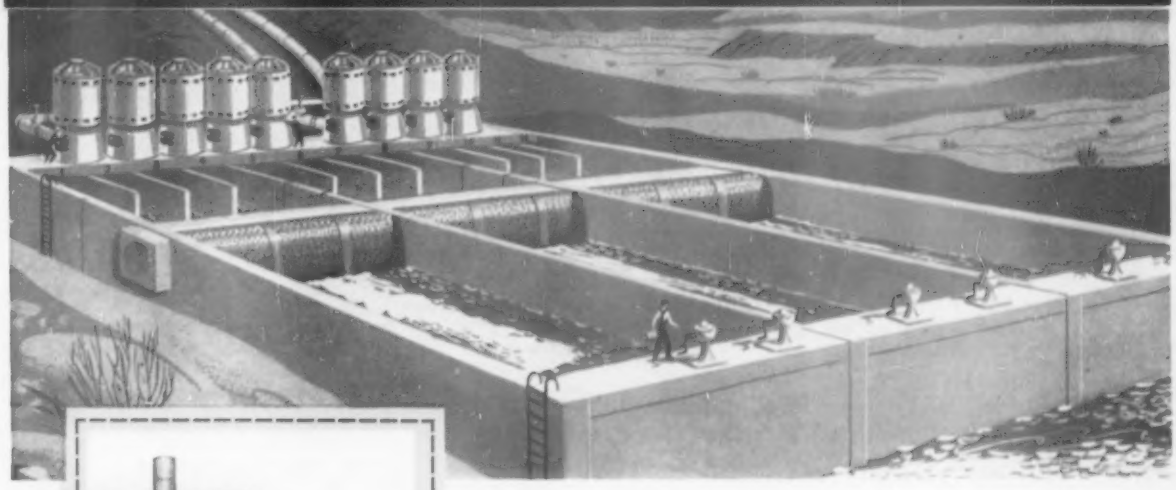
D. K. Ludwig, president of National Bulk Carriers, Inc., and sole owner of Panama Refining, Inc., announced that his firm's refinery will have a 70,000-bbl. daily capacity. Ludwig said no details of plant design can be disclosed at this time.

Tax advantages . . . The Panamanian Government paved the way for its sudden refinery construction boom with a new decree. It offers a refinery a "tax umbrella" for 25 years of operation. Products exported are exempt from income taxes. The decree became law the day before the government signed contracts with the two companies to build the refineries and accompanying anhydrous ammonia and urea plants *(The Oil and Gas Journal, May 14, page 116, and May 21, page 145).*

Shaheen said last week in New York that his company is backed by investment capital and that a number of individuals are interested in the firm. He and his partner in several other investments, Eugene du Pont III, of Wilmington, Del., are the only two he identified.

Shaheen said he plans a "crash program" to build the refinery as quickly as possible. No contract has been let and final plans for process units are not complete. Foster Wheeler Corp. is acting as adviser to the company.

Giant new Tidewater refinery selects Byron Jackson pumps for 400 MGD service



TWO STAGE BJ PUMP shown without discharge head and motor.

SPECIAL ENGINEERING REPORT AVAILABLE:

A special engineering report with detailed flow diagrams and color photographs is available. Also, a factual full-color motion picture report can be arranged on request.

Tidewater Oil Company's new Delaware Flying A Refinery is one of the world's largest new refineries. This giant refinery—15 miles south of Wilmington—will use more than 16 million gallons of water per hour. To accomplish this mammoth pumping job, Tidewater and C. F. Braun & Co. (engineers and constructors) selected nine BJ 2000 hp vertical river intake pumps, with provision for installation of three more units.

BJ Pre-Tested the Actual Installation

Because of the special intake system and the untested hydraulic problems involved, it was decided to pre-test the actual pumping conditions. A scale model intake installation—including nine pumps—was constructed in Byron Jackson's Los Angeles hydraulic laboratory. Actual field operations were duplicated in this model. All tests confirmed the correctness of engineering and pumping specifications. In addition, before delivery, Byron Jackson performed exacting hydraulic tests on each of the nine pumps. *These giant pumps tested to an 89.5% efficiency!*

Each BJ pump will be driven by a 2000 hp electric motor at 600 rpm against a total head of 184 feet. Because of the brackish salt water, pump cases, columns and impellers are made of high alloy stainless steel.

BJ

SINCE 1872

Byron Jackson Pumps, Inc.

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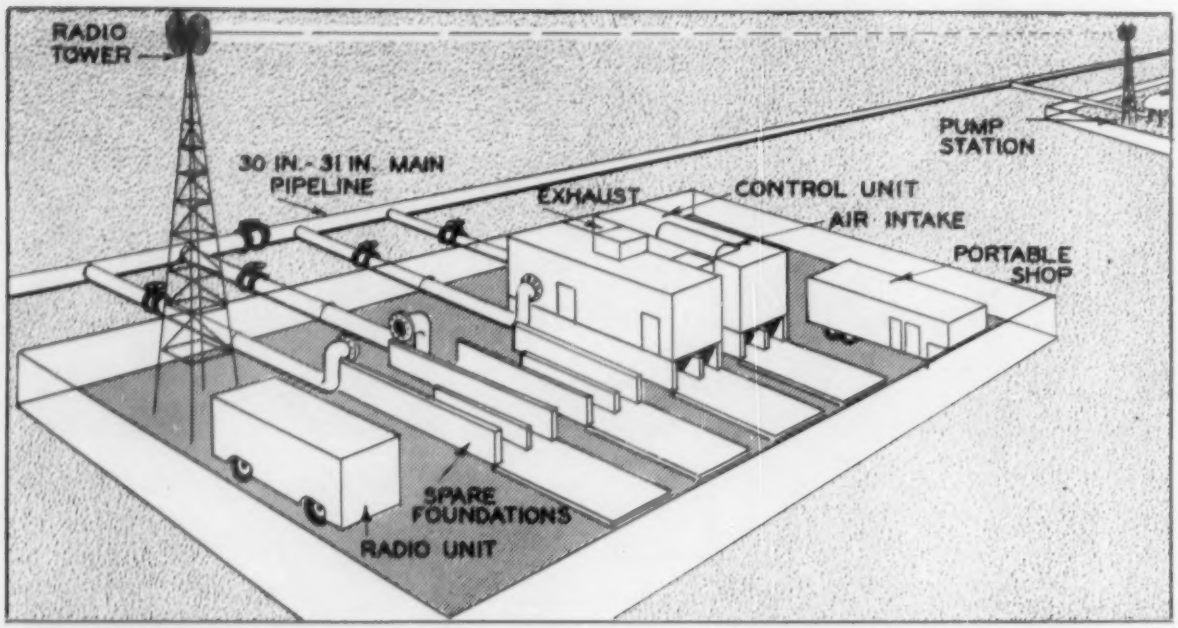


PUMPING STATION ON WHEELS is the idea behind the four 5,000-hp. gas-turbine auxiliary pumping units being installed by Tapline. Four foundations are laid at the planned stations. Four vans then are wheeled in carrying the pumps, air filters and controls, radio and standby power equipment, and a repair shop. Two foundations are spares for bringing in standby units for repairs.

Gas Turbines to Step Up Tapline Flow

Trans-Arabian pioneers their use on big oil-line pumps; unusual units also will be portable and radio controlled

THE first use of combustion-gas turbines on a major crude or products pipeline will be made soon by Trans-Arabian Pipe Line Co.

Trans-Arabian is installing four unusual auxiliary pumping units as the heart of a project to increase crude-throughput capacity on its line by 90,000 bbl. daily.

The turbine-driven units also will be compact and portable, as well as radio controlled and unattended.

They are designed for heavy duty under severe desert conditions, where temperatures change as much as 70° on some days and where 110° readings at midday are normal in summer.

The pumping units are scheduled to go into operation January 1, 1958. They will boost capacity of the 753-mile Tapline from the present 320,000 bbl. daily to 410,000 bbl. daily. The 30-31-in. line carries crude from Qaisumah station near Hafar al Batin in Saudia Arabia to Sidon, Lebanon.

Arabian American Oil Co. operates another 314-mile section of line from Abqaiq tank farm near the Persian Gulf to the station where Tapline takes over.

The units will be installed about midway between pumping stations at Qaisumah, Rafha, Badanah, and Turaif in Saudi Aradia. One also will be set up at Qaryatain in Jordan.

What's planned . . . A. E. Olson, Tapline's chief field engineer and construction manager, said that the expansion project "was made possible by focusing the thinking of several technical fields on our particular problem."

Here are the highlights of the $14,000,000 program:

. . . **Fixed foundations** will be built to support portable vans housing the turbine, pump, radio equipment, controls.

. . . **Special trailers** will carry the turbine and pump back to the maintenance shops at Turaif for overhauling.

. . . **A spare turbine and pump** will be available for installation at any unit while the regular power package is down for repairs.

. . . **Filtered air** will be used to pressurize the turbine room in order to keep out dust and cut down the risk of vapor accumulation.

. . . **Continuous operation** in case of temporary loss of radio contact is possible because of built-in safety devices in auxiliary units. But main pump stations can shut down auxiliaries at any time by reducing pressure.

Four vans per unit . . . A complete auxiliary unit will consist of four vans, their prepared foundations, radio tower, and manifolds.

One van will carry a two-shaft combustion-gas turbine and a direct-connected centrifugal pump. It will weigh 110 tons and be 53 ft. long, 15 ft. wide, and 19 ft. high.

Another van will carry air filters and controls. It will weigh 55 tons and be 54 ft. long, 15 ft. wide, and 21 ft. high. The third van will carry radio equipment and a standby power plant, while the fourth will carry tools and spare parts and have emergency quarters for personnel. The third and fourth vans will be smaller and lighter than the first two.

Dual foundations and manifolds will be built at each site to permit installation of the spare turbine and pump with minimum throughput loss when the operating unit is removed.

Two-shaft turbine . . . The simple-cycle, two-shaft turbine at each unit will supply 5,000 hp. at 110° air temperature at 2,600 ft. above sea level. Available power will increase about 5 per cent with each 10° drop in temperature.

The turbine will use filtered and metered crude taken from the main line. One shaft will drive a multistage axial-flow air compressor at the most efficient speed. The second, or power, turbine drives the pump at the speed required for a given operating condi-

tion. General Electric is building the turbines.

The Byron Jackson single-stage centrifugal pump at each unit will be driven directly by the turbine at speeds from 4,500 to 5,500 r.p.m. under normal condition. A fire wall will separate the turbine and pump.

Suction pressure, discharge pressure, discharge pressure controller set point, and filtered air temperature of the auxiliaries will be transmitted by radio to the controlling station.

Safety precautions . . . The auxiliary units are designed for heavy duty, and also with elaborate safety devices in case something goes wrong. The units will automatically shut down for several reasons: excessive vibration, low suction or high discharge pressure, high bearing temperatures, or indications of fire.

Main-line oil pressure operates the suction and discharge valves. These close when the unit shuts down, reducing the possible fuel supply in case of fire. Another feature permits the operator in the pump station to listen to either the pump or turbine room by radio.

The elaborate air system will ventilate the control van as well as maintain a pressurized air flow through the turbine room. The pump room will be kept under a slight negative pressure relative to the turbine room.

Other facilities added . . . Tapline's expansion project will require considerable facilities in addition to the auxiliary units.

Necessary housing, shops, and utilities will be built this year and in 1957. Pumping engines at present stations also will be modified to increase power, and an auxiliary unit will be added at Turaif.

A 180,000-bbl. floating-roof tank will be built at three present pumping stations, Rafha, Badanah, and Turaif. They will permit brief shutdowns for maintenance or inspection at the auxiliary units without interfering with operations in other sections. Three 180,000-bbl. floating-roof tanks also will be added to the Sidon tank farm. They will keep the farm's active storage capacity at about 5 days with the increased line throughput.

Along with the operating advantages of the auxiliary units, the package-type construction permits comparatively early completion of the project.

One of the new type turbine-driven pumps will be set up and tested next fall on Aramco's section of the line, between Abqaiq and Qaisumah. Tapline will serve as technical consultant.

Pemex Pushes Gas Hunt

Mexican firm will have 18 rigs active in Reynosa area by midsummer, plans pipeline expansion to serve new industry

GAS fields of the Reynosa area of northeastern Mexico are growing fast.

In fact it became apparent last week that producers will hardly miss the 100,000 to 200,000 M.c.f. daily of natural gas which Texas Eastern Transmission Corp. wants to move across the border into the United States.

At least 425,000 M.c.f. of gas daily is now available from the Reynosa fields. If the area's gas reserves continue to increase at the present rate, Reynosa should be able to supply 1,000,000 M.c.f. of gas daily in the not too far distant future.

Petroleos Mexicanos now has 11 active rigs in northeastern Mexico and expects to add another 7 rigs by midsummer.

Industrial boom . . . Unofficial Mexican sources said last week that Pemex is getting ready to build a new 22-in. gas pipeline from the Reynosa area to Monterrey.

It will supplement fuel supplies to a growing industrial area. Contract for building the new line is expected to be let immediately.

Pemex officials revealed last week that available gas supplies from northeastern gas fields have increased almost 50,000 M.c.f. daily in the last 6 months.

Texas Eastern signed a contract with Pemex last September which calls for an initial supply of 100,000 M.c.f. of gas daily with the possibility of boosting this figure to 200,000 M.c.f. daily. Texas Eastern has never disclosed the contract price for the gas, but Mexican sources have put it at 14.2 cents per M.c.f. *(The Oil and Gas Journal, September 5, 1955, page 66 and October 3, 1955, page 98).*

The American company's request to import Mexican gas has not been approved by the Federal Power Commission.

Texas Eastern would take delivery of the gas at Pemex's new $7-million absorption plant at Reynosa which is designed for an output of 30,000 M.c.f. daily. The new plant went into operation last fall and is now processing gas for sale to distributing companies serving the Monterrey area.

Expansion . . . In addition to the new Reynosa-Monterrey pipeline reported in Mexico last week, Pemex has long planned to extend its gas transmission facilities from Monterrey to Torreon and possibly to Chihuahua. This will further assist in industrializing those areas of Mexico.

After the Reynosa absorption plant was completed last fall, Pemex awarded its builder, Hudson Engineering Co., Houston, another contract. It calls for a second and identical plant at Tabasco in Mexico's isthmus area. Antonio Bermudez, general director of Pemex, said when the contract was let that the Mexican sulfur industry would take at least 100,000 M.c.f. daily of the plant s output *(The Oil and Gas Journal, February 6, 1956, page 77).*

Mexican sources last week emphasized that the 425,000 M.c.f. daily figure pertains strictly to gas from the Reynosa area fields. It does not include the gas supplies available from fields in other areas of Mexico such as those in Tabasco.

Jamaican Wildcat Spudded

Jamaican Stanolind Oil Co. has spudded its first Jamaican exploratory well and is drilling ahead in limestone below 70 ft. The wildcat is the 1 Santa Cruz, located 5 miles south of Malvern and 1 mile east of Munro College in St. Elizabeth Parish.

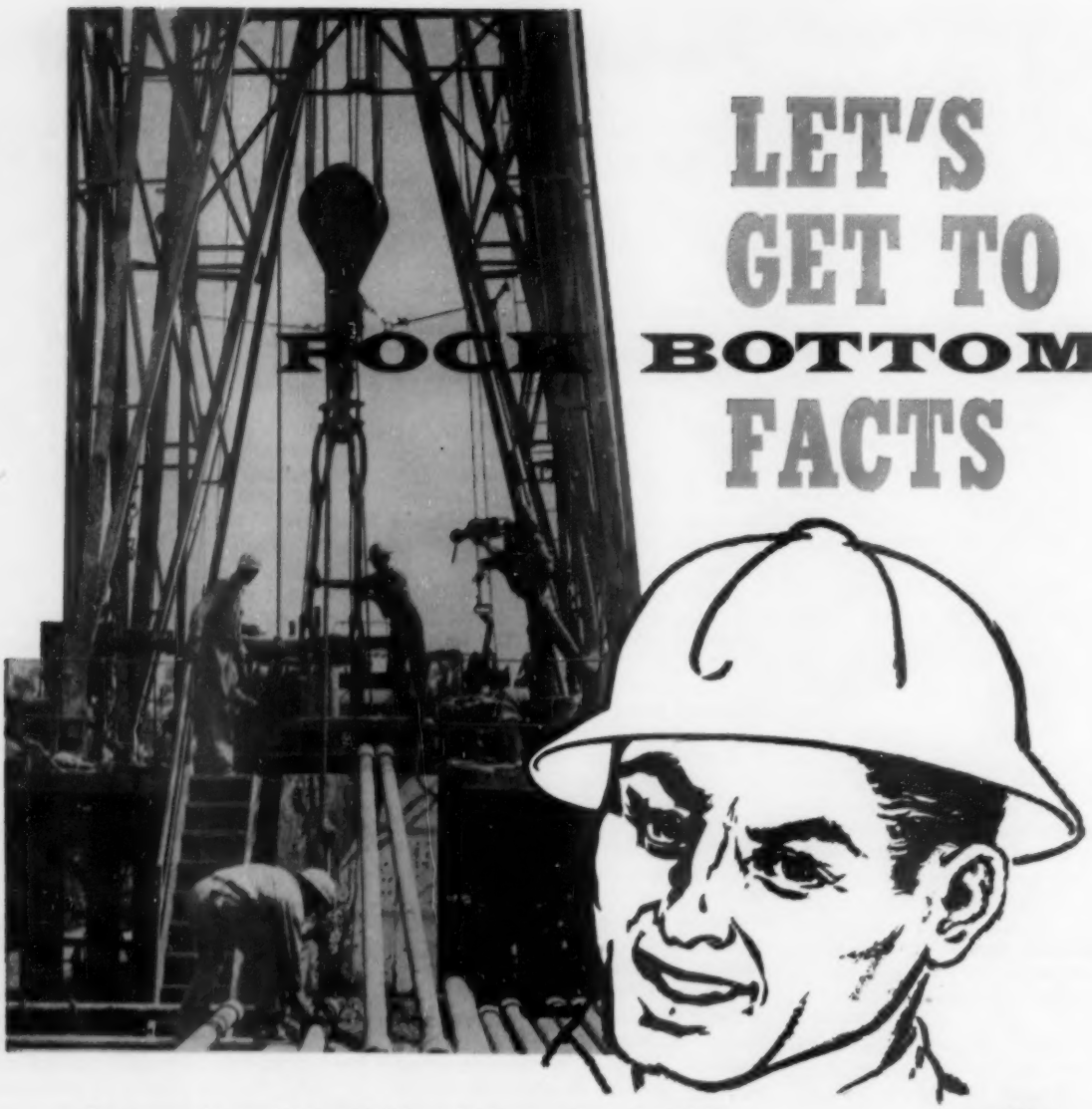
The test is located on a structure identified by aerial photos and later confirmed by surface geological crews and seismic tests. The well is scheduled for 6,000 ft. and is part of the company's $2 million exploration program on 5½ million acres on the island and its tidelands.

Jamaica's first wildcat was drilled a year ago by Base Metals Mining Corp. The 6,000-ft. test located at Negril Spots was dry but encountered interesting shows of oil. Jamaican Stanolind later acquired Base Metals' concession *(The Oil and Gas Journal, January 9, page 74).*

Texaco May Buy Trinidad

The Texas Co. is offering to acquire all the outstanding capital stock of Trinidad Oil Co., Ltd., it was announced in London last week.

Texaco's offer was 80½ shillings ($11.235) per 5-shilling (70 cents) stock unit, subject to certain conditions which still are under discussion. Trinidad was quoted recently on the London Stock Exchange at 41 shillings ($5.74).



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Guatemala Search Near

Prospects point to start of exploration this year after bidders and government resolve overlapping applications

GUATEMALA moved a step nearer last week to granting concessions to 22 of the 29 applicants seeking exploration acreage.

The General Bureau of Mines and Hydrocarbons declared 17 companies eligible for all the acreage on which they sought licenses. The other 5 were ruled eligible for varying amounts.

The action came after the Central American country granted its first concession to Signal Exploration Co., subsidiary of Signal Oil & Gas Co. *(The Oil and Gas Journal, June 4, page 77).* The 673,000 acres approved for Signal, located in the southeast corner of the Department of Peten, were not sought by anyone else. Other applicants have been working for weeks to resolve overlapping applications.

Eligible companies . . . Declared 100 per cent eligible were Tidewater Guatemala, Ltd., Ohio Oil Co. of Guatemala, Sohio Caribbean Co., Continental Oil Co. of Guatemala, Guatemala Atlantic Corp., Petroleum Investments (Overseas) Ltd. (Shell), Amerada Petroleum Corp. of Guatemala, Texas Petroleum Co., Union Oil Co. of California, Esso Standard (Guatemala) Inc., Sun Production Co., Central American Oil & Mining Co., Inversiones Guatemaltecas Americanas S. A., Cia. Petrolera California, Ltd. (Standard of California), Jaime Allan Willard Duran (backed by Husky Oil Co.), Petroleos Guatemaltecos S. A. (backed by Santa Fe Drilling Co.), and Signal Exploration Co.

Seaboard Exploration Co. of Illinois was ruled eligible for 15.3 per cent; Bandini Petroleum Co., 67.7 per cent; Story J. Sloan, Houston, 64.6 per cent; Antonio Molina Murillo, 5,000 hectares (minimum); and Petroleos Atlas de Guatemala, S. A. (an American group), 25.8 per cent.

Ineligible companies were Archer Oil Co., Cia. Petrolera Guatemalteca, S. A., Shawano Development Corp., William Lawrence Norman Stone of Houston, A. K. Swann of Evansville, Ind., Halbert & Jennings, and Garfield & Pasternack, Denver.

Overlap problem . . . Eligible bidders have until July 3 to resolve overlaps, which in some cases involve several companies.

The government may extend the time or put the area in conflict up for bid. Only the applicants involved in the conflict may bid. If the partially eligible bidders cannot select the acreage allotted them in 15 days, then the government bureau may do it for them.

After the General Bureau of Mines and Hydrocarbons approves a concession grant, it does not become effective until the minister of labor and economics certifies it. Progress toward starting exploration is rather slow as the petroleum law is new. Oil companies—and the government as well—are learning to operate under it as they go along.

Prospects . . . The geology of Guatemala is largely unknown, and this fact is reflected by some applications which simply cover rectangular blocks.

Some preliminary exploration was done prior to 1949, and some aerial photographic and surface geology work was performed by some companies before making their bids last year. The area of interest is centered in Peten, in the northern part of the country, which is a flat, dense jungle. The southern part is mountainous.

The area where much of the exploration will be carried out receives 200 in. of rainfall per year while other sections are so arid that lack of water is the greatest problem.

The sediments in the north are Tertiary and Cretaceous, chiefly calcareous deposits, with a little sandstone and shale. It's not known how thick they are. There is structure of some character but it is difficult for geologists to resolve the quality of their data on the basis of studies at this point.

Several companies are bidding for acreage along the border of British Honduras, in the vicinity of a Gulf Oil Corp. wildcat. They would give a lot to know what that well found, but the only information thus far is that it was bottomed at 9,000 ft. still in sediments of undisclosed age.

The start of exploration will depend on how soon overlaps are resolved, but Signal certainly will start its program this year and others probably will also.

Operators describe the country as one of the most expensive and difficult in the world for exploration, because of the almost impenetrable jungles. Some rigs and other equipment may be flown in.

It is estimated that a wildcat will cost $1,000,000 and as much as $2,000,000 in some regions. A seismograph crew will cost several times as much as one in an easy shooting area such as Oklahoma. Its chief attractions are the fact it is virgin territory, located in Western Hemisphere, and in the backyard of American oil companies.

Hughes Speeds Turbodrill Bit

HUGHES TOOL CO. has concluded an exclusive world-wide license agreement with a French turbodrill manufacturer to develop special rock bits for turbodrilling.

The contract was executed last week in Paris with Les Establissements Neyrpic S. A., Grenoble, France. Neyrpic is one of the oldest and largest hydraulic engineering and manufacturing firms on the continent. It recently has developed, manufactured, and successfully field tested turbodrills in Western Europe.

Negotiations have been pending for some time between Hughes and Neyrpic over developing a special rock bit for the turbodrill.

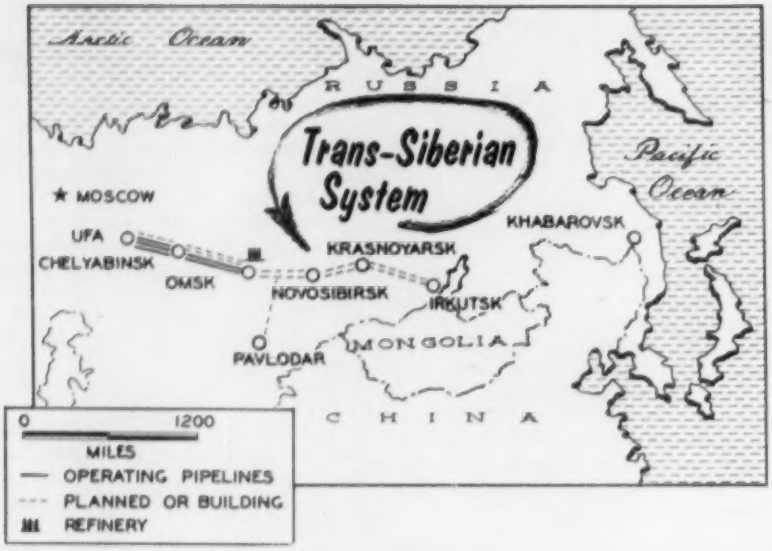
F. W. Ayers, senior vice president and general manager of Hughes, said his firm has been doing special research on rock bits for new high-speed hydraulic drilling for some time. Hughes, however, has no plans for construction of the turbodrill itself.

Under its agreement, Hughes will have access to specialized technical information on the turbodrill developed by Neyrpic and help of Neyrpic engineers. Ayers said this will speed development of a rock bit specially adapted to turbodrilling.

Neyrpic engineers will be sent to Houston at once for studies and tests in Hughes' advanced research and engineering laboratory.

Ayers reported that Alfred Wirth & Co. of Erkelens, Germany, has been granted an exclusive license to make, rent, and service the Neyrpic turbodrill in Germany. It also has the right under special arrangements to rent the drill in several other countries. Wirth also is a rock bit and tool-joint licensee of Hughes.

Turbodrilling hit the international headlines recently when Dresser Industries, Inc., Dallas, made an agreement with the Russians to manufacture their drill in the United States. The Commerce Department blocked the deal. But Dresser says it will still make a turbodrill with assistance of French experts.



Russians Laying 2,300-Mile Pipeline

RUSSIAN pipeliners are busy working on a record 2,300-mile crude-oil and products pipeline system. It stretches from Ufa and the Tuimaza fields in Bashkiria to Irkutsk near Lake Baikal (see map).

The project is scheduled for completion during the sixth 5-year plan (1956-1960). Eastward extension to Khabarovsk is planned during the 1960s.

Two of the lines connecting Ufa-Tuimaza with a new refinery at Omsk have been completed. A third is under construction. And a fourth will be started shortly. Work on the Omsk-Novosibirsk section also is under way.

Soviet officials have not revealed size of pipe being used. But the Russians are known to have encountered trouble manufacturing large-diameter pipe.

Import needs burdensome, so . . .

. . . Brazil Seeks Cheaper Crude

BRAZIL hopes to either export its high-gravity, paraffin-base Bahia crude or exchange it on the world oil market for cheaper crude for use in its domestic refining industry.

The sale-or-swap plan was disclosed recently by Col. Janary Nunes, who took over the leadership of Petroleo Brasileira, S.A. (Petrobras), Brazil's state-owned oil agency, last February. Colonel Nunes told a meeting of Brazilian industrialists in Sao Paulo he hopes Petrobras can put the plan into action by next month.

Colonel Nunes said the paraffin-base crude which Brazil produces brings about $4.50 a barrel on world oil markets. He hopes to sell the production or exchange it for $3-a-barrel crude and help in a small way to overcome the burden of import needs.

Production up . . . The new Petrobras chief also used some figures that are considerably higher than recent official reports of Brazil's production. Colonel Nunes said Brazil's Bahia and Reconcavo fields are now producing about 20,000 bbl. daily. He said Petrobras expects to boost this figure to 40,000 bbl. in 1957.

The most recent official figures released by Petrobras several months ago indicated the country should be producing only about 7,000 bbl. daily if production has continued to climb. Last year Petrobras averaged 6,000 bbl. daily, an increase of 140 per cent over 1954's 2,500 bbl. daily.

Colonel Nunes also placed Brazil's current consumption at 200,000 bbl. daily, which is greater than the country's previously recognized demand by about 35,000 bbl. daily. In connection with the consumption he quoted, the Petrobras chief said Brazil hoped to be refining 200,000 bbl. daily by 1960. He said present daily refinery runs are about 115,000 bbl.

Discovery on pump . . . The new Petrobras president told the Sao Paulo industrialists that Nova Olinda, the Amazon basin discovery which created a sensation in March 1955 will have to be pumped. Colonel Nunes said the 40°-gravity oil found at the 8,915-9,059-ft. interval rose only 7,900 ft. in the drill pipe.

He said Nova Olinda 1 is believed to be on the flank of the productive structure. Two more wells, Nova Olinda 2 and 3, are being drilled on an island in the Rio Madeira, an Amazon tributary, on what is believed to be more nearly the center of the structure.

Austrian Test Hits

Alpine foothills well may open new field for R.A.G.

AUSTRIA last week got its most significant oil strike since departure of the Russians. The possible field opener was brought in by the same private Austrian oil company which unwillingly provided the know how for Russians to develop the nation's biggest oil fields.

Rohoel-Gewinnungs A.G. (R.A.G.), jointly owned by Socony Mobil Oil Co. and Royal Dutch-Shell, has tested 250 bbl. daily of 34°-gravity crude in a wildcat in the Alpine foothills of mountainous western Austria. The region is clear across Austria from the Vienna basin oil production.

The well, Puchkirchen 1, was spudded last September about 30 miles east of Salzburg and projected to 10,000 ft. It drilled into basement rock at 8,500 ft., however, and the production was tested in an interval at about 7,750 ft.

An R.A.G. spokesman in Austria last week said production is coming from a section only about 6 ft. thick. He said he expected offset wells to discover a thicker section of the pay formation.

The Matzen-Auersthal field, Austria's largest producer with an output of about 55,000 bbl. daily, was developed by the Russians during the postwar occupation of Austria on a concession formerly held by R.A.G. The Soviets used all R.A.G.'s records and seismic data to develop the field.

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The Journal has extra copies of the 16-page, two-color special section, "Automatic Custody Transfer . . . of Crude Oil at the Lease." This special section begins on page 109 of this issue. To get your reprint copy send 50 cents to:

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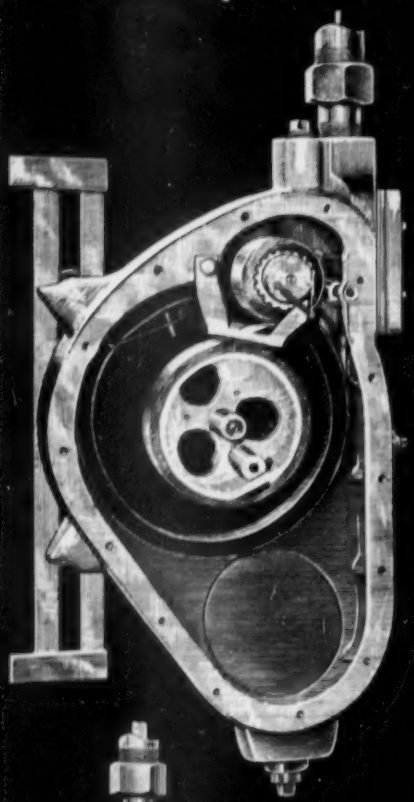

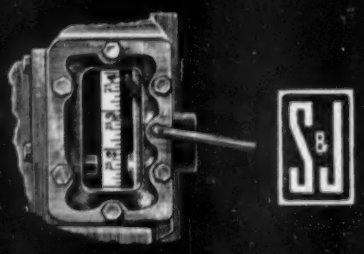

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Automatic Custody Transfer

. . . .of crude oil at the lease

JOE'S perplexed. Just what is this "automatic custody transfer" he keeps hearing about? What will it mean to his operations as a producer? And when Joe puts on his other hat and becomes a pipeliner, how's it going to help him in that business? What are the mechanics of automatic custody transfer? Who's gonna' gage the tank, put it on the line, and grab samples? What's to keep Joe from getting hooked, whichever hat he wears?

In looking for answers to these and other questions, The Oil and Gas Journal talked to many people directly involved with plans for automatic custody transfer at the lease. We find that a general definition of the process is simple enough. It is merely the transfer of custody of oil to a pipeline at a producer's lease without a repsentative of either having to be present—and with all measuring and testing done automatically.

Costs of installing instruments and equipment for automatic custody transfer will range from $3,000 to $5,000, depending on system chosen, size of lease, and frills of instrumentation.

What will automatic custody transfer save? This also will vary widely. To some producers who have automatic producing operations, it will mean a further reduction or reshuffling of manpower and offer a quick payout. In other cases the payout will be slower, depending on reduction in lease tankage and more accurate measurements of crude-oil volume and quality.

To pipeliners, it can mean a reduction in gager forces. And it may allow smaller lines and stations because load will be more constant. To both, it will mean more reliable gathering-system operations—oil can be run in all types of weather and on schedule.

How will it be done? . . . The general idea of automatic custody transfer is simple, but details are more complex. Instrument specialists, pipeliners, and producers all have many different ideas on how the job should or will be done. Some of those ideas are beginning to jell, and it's those we want to report on. In the following pages, you'll find the most important basic methods which will lead off in this move to automatic custody transfer. Briefly, it runs like this:

. . . **For volume**—dump tanks will be used at first by most But p.d. (positive displacement) meters will be coming on fast.

. . . **For temperature**—both electric and pressure-bulb averaging thermometers will be used with dump tanks, none with self-compensating p.d. meters.

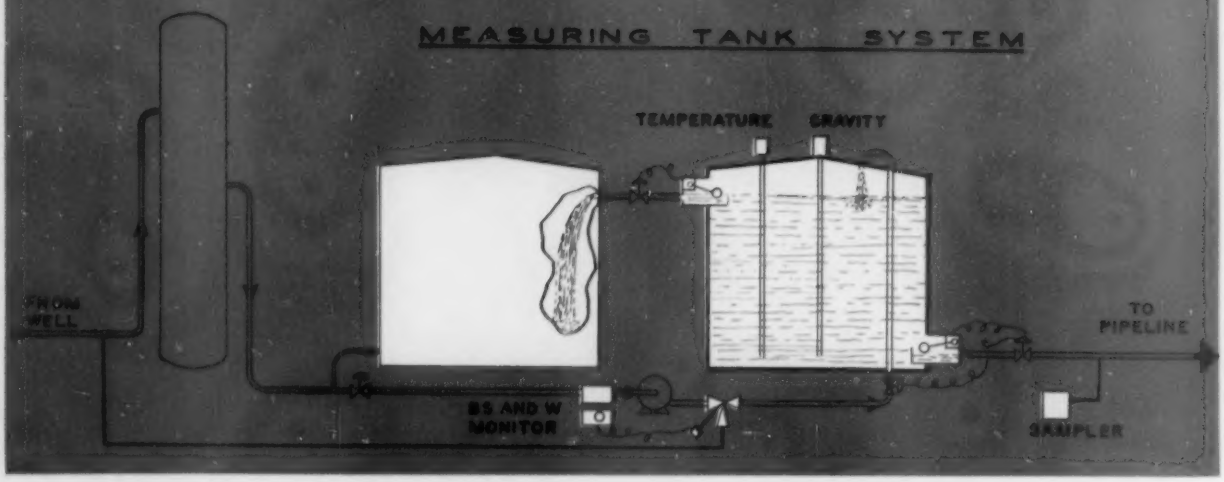
. . . **For gravity**—buoyant force from a large float submerged if volume measurement is by dump tank. With p.d. meters, gravity will come from manual testing of automatically drawn samples.

. . . **For b.s. and w.**—either a capacitance-cell electronic instrument or a differential-pressure system weighing filtered against unfiltered oil. These will be monitors only, keeping bad oil from the pipeline system. Actual b.s. and w. content will come from shakeouts of samples.

. . . **Safeguards**—here are a flock of minor features and safeguards which must be designed into the automatic battery. Fill and discharge valves must be interlocked, counters duplicated, etc. Check the last pages of this special section for a rundown on some of these. But first, read of some of the general considerations and the details of how the basic measurements will be made. You'll find these on the following pages.

WHERE DO WE STAND TODAY ON

TWO BASIC METHODS OF MAKING AUTOMATIC CUSTODY TRANSFERS are available now. One uses a large dump (or measuring) tank which receives oil from the lease treater, holds it for weathering and property measurements, then dumps a fixed volume to pipeline. B.s. and w. content is monitored as oil goes into the tank and a diverting system sends bad oil back to the treater. Modified version of system uses two measuring tanks in parallel, one dumping to pipeline while other fills.



AUTOMATIC custody transfer has been a magic phrase for years—stirring imaginations of producers and pipeliners alike. Now it appears just a matter of time—maybe a short time—until automatic custody transfers are routine at a great number of pipeline connections.

Technical and economic barriers have almost been broken by cheaper, better equipment. Joint tests by several producers and pipelines are erasing doubts and prejudices. An A.P.I. committee report to be out this year will reflect confidence in the accuracy and reliability of several methods of doing the job.

Automatic custody transfer offers several advantages to both producer and pipeliner. By allowing a reduction in lease tankage, it will mean less evaporation loss and less money tied up in oil aboveground. It will improve accuracy in measuring volumes, lessen chance of errors by removing the human element, and probably simplify oil accounting and computing procedures. And by reducing pumper and gager time required to run oil, it will allow manpower to be used more efficiently. For the pipeliner it will mean more efficient operation of his gathering system and smoother load factors.

A major advantage is that the equipment necessary is complicated and will require trained technicians who must give it frequent maintenance to assure accuracy and reliability.

Why delay? . . . With so many advantages offered, why has the industry waited so long? Automatic production of leases has proved economical and practical for years in a number of fields. Likewise, automation is no stranger to pipeline operation.

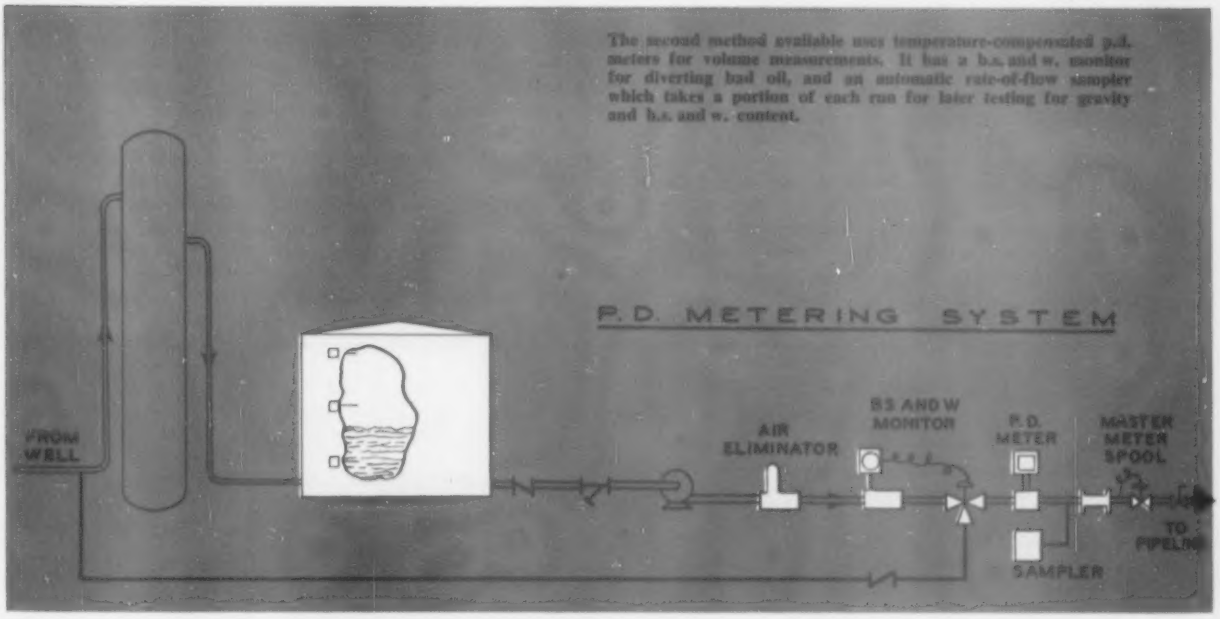
But coupling automatic production and automatic pipeline gathering has been hampered by the problem of custody transfer. General boundary conditions on this problem are easily set. The oil has only to be measured for volume, temperature, gravity, and b.s. and w. content. But working out details of instruments and systems acceptable to all parties has taken years.

Now general acceptance of the concept appears just around the corner. Big new leases will come first. Economics are definitely in favor of automation where volume is high and pumper and gager forces are large, or where automatic equipment can be put in as original instead of replacement items. Then, as equipment gets simpler and cheaper, smaller and older leases and their pipeline connections will be put on an automatic basis.

Before this can happen, some rules set up by state commissions will have to be changed. For example: the Texas Railroad Commission Rule 9 requiring manual gaging of oil before acceptance by a pipeline; the Louisiana Conservation Commission Order 29-B requiring manually installed seals on tank valves; and so on. But once pipelines and producers indicate a readiness to go to automatic custody transfer, there is little reason to expect state commissions to balk at changing rules.

Present work . . . Most major producers have done a lot of work toward automatic custody transfer. Gulf Oil Corp., one of the pioneers, recently announced the industry's first automatic, unattended sales from a lease. This automatic transfer is to Kaw Pipe Line Co. in Kansas. Volume measurement is by dump tanks, using the same equipment Gulf had on test and demonstration near Tulsa for over a year before moving it to Kansas.

AUTOMATIC CUSTODY TRANSFER?


The second method available uses temperature-compensated p.d. meters for volume measurements. It has a b.s. and w. monitor for diverting bad oil, and an automatic rate-of-flow sampler which takes a portion of each run for later testing for gravity and b.s. and w. content.
P.D. METERING SYSTEM
FROM WELL
AIR ELIMINATOR
B.S. AND W. MONITOR
P.D. METER
MASTER METER SPOOL
TO PIPELINE
SAMPLER

Shell Oil Co. has made extensive tests of automatic equipment in West Texas and appears ready to make the step. *(See The Oil and Gas Journal, October 17, 1955, page 111, for a complete description of Shell's method.)*

The Texas Co. has one automatic-custody-transfer installation working in South Louisiana in West Cote Blanche Bay field. Transfer is to Texas Pipe Line Co. Dump tanks are used here also. Another Texas Co. automatic battery will be placed in Osage County, Oklahoma, where delivery will be made to Mid-Continent Pipe Line Co.

Both of these installations will flow oil into conventional tanks for hand gaging and testing after running through the automatic equipment. In Louisiana, the test period will last at least 3 months.

Phillips Petroleum Co. plans two automatic-transfer installations for southern Oklahoma. Dump tanks will also be used here.

Sinclair Crude Oil Co. plans automatic transfers using p.d. meters to Sinclair Pipe Line Co. from a lease in Wyoming. Long tests on meters there show extremely small deviations from hand-gaged volume.

Humble Pipe Line Co. has been testing p.d. meters for automatic custody transfer in East Texas and near Anahuac, Tex., for the past 2 years. This company may be the first in Texas to seek modification of Railroad Commission rules to allow automatic custody transfer.

Besides these individual company examples, much work has been done by the A.P.I. committee on sampling, gaging, and testing. The committee won't be able to codify or standardize any one method for a long time. Actual field use must come first because codification of untried methods or systems just can't be done. But in general the committee has made a quite detailed analysis of several different schemes. Its first product will be an information bulletin on basic designs.

What Lies Ahead?

Automatic custody transfer of the present and near future will be principally by dump or metering tanks. But many people feel dump tanks are only an intermediate step. The final method will use either positive-displacement or mass-flow meters. All measurements and tests will then be made with continuous measuring instruments. Present continuous-reading gravitometers and b.s. and w. monitors will be correlated with flow instruments to produce a reading of average gravity or b.s. and w. in each batch delivered.

In the near future, recording of data on quality and quanity will be by conventional circular or strip charts. Manual interpretation will still be needed for calculating deductions and net volume. Later on, such measurements may be recorded directly on punch cards or tape, allowing rapid processing of data from many leases or an entire gathering system by electronic computers. Automatic, remote transmission of data from individual leases into central computing offices will also prove feasible.

There is no visible ceiling on use of automatic equipment in producing and gathering operations. It isn't unreasonable to expect and work for complete automation of large gathering systems. But that may be far down the road. The industry first has to be satisfied with the beginning steps as outlined in the following pages of this section.

VOLUME MEASUREMENT

VOLUME measurement is the most important measurement required for crude-oil custody transfer.

Dollarwise, determination of gross volume is the most important step in exchanging custody of oil. So for automatic exchange, designers have explored several methods in looking for a sure-fire system.

Basically, there are only two ways of measuring volume—level in a calibrated tank or use of a meter actuated by flow. Of the flow meters, only the positive-displacement type has proved to have the inherent accuracy needed for automatic-custody-transfer purposes. Accurate volume measurement by calibrated tanks depends mostly on preciseness of strapping and sensitivity of level controls. A variety of ways to measure and control level have and are being tried. The common tank gage, with associated switches operating from its tape reel, is a strong competitor with weirs, capacitance probers, and other types of level controls.

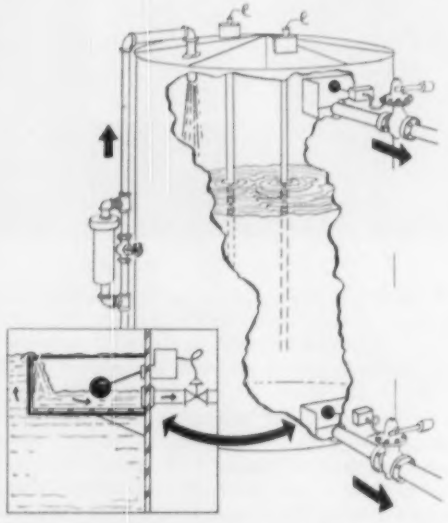
An outstanding thing to note about the industry's approach to the volume-measurement problem is the desire for more accuracy. In common use now is the ¼-in. allowance in field gaging, which corresponds to an accuracy of about .3 per cent in a 500-bbl. tank. This won't be good enough for automatic custody transfer. Any system chosen will probably need an accuracy of at least .1 per cent.

The Metering Tank

A souped-up version of a common stock tank will be the most widely used method of measuring volume for automatic custody transfer, at least in the early stages. Dump or metering tanks will require no maintenance, will handle any type of oil, can be sized for any volume, need calibrating only once (barring incrustation problems) and can be made into extremely accurate volume-measuring devices. Two metering tanks in parallel, one dumping while the other fills, will give almost continuous flow to pipeline.

Operation of the dump tank is basically very simple. A stock tank is carefully strapped between two fixed levels. The producer fills the tank to the high level, then turns it into the pipeline which withdraws to the low level. A counter records the number of dumps, hence the gross volume can easily be figured. Other measurements allow correcting this to net volume.

Assuming adequate strapping, it isn't really the tank but its accessories which determine accuracy of the dump tank method. Accessories meaning those items which fix the fill and drawdown levels. A half-dozen devices have been suggested for this—float-type tank gages, float switches, weirs and float switches, capacitance probes, pressure switches, etc. All are capable of giving more accuracy than the industry now demands in field gaging.



Measuring (or dump) tanks will be used by most companies at first.

Weir method . . . Greater accuracy can be obtained by use of weirs than by any other means, and this is the leading method being considered. Two weir or spill-over boxes are placed in the dump tank. One, near the top, sets the high level. Its outlet drains into an overflow tank. The bottom weir box fixes the lower level and its outlet is the pipeline connection. Thus, a constant known volume is dumped each time.

Distance between the weir lips can be established with precision. Rigid mechanical coupling between top and bottom boxes can hold this distance. Thus volume measurement by this method is accurate and constant.

There's only one thing to look out for in designing your weir—don't make it too small. A small weir used with heavy crudes in cold weather may give an excessively long draindown time and throw either lease or pipeline operation off schedule.

Initial filling is to a level above the top weir where a high-level switch causes filling to cease. Oil above the weir level drains through the weir box into the overflow tank. A switch inside the weir box prevents continuance of the metering cycle as long as fluid is draining into the weir box. After drainage has stopped, this switch will close—automatically starting the property measurement cycle (i.e., taking readings of gravity, temperature, b.s. and w.). At the end of this cycle, the tank will be switched to the pipeline.

The liquid then empties down to the level of the bottom weir. A level switch within the lower weir box prevents closing of the pipeline valve until overflow into the box has stopped. After drainage has stopped and a preset time has elapsed, the pipeline valve closes and the fill cycle starts again. (Some arrangements allow for recycling the tank bottoms through the lease treater at end of each pipeline run).

Float-type gages . . . Now codified by A.P.I., the float-type tank gage will get big play in automatic custody transfer. In this type of gage, a float rests on the oil surface. A steel tape attached to the float runs out of the tank on pulleys and is spooled onto a reel at the tank base. This tape is calibrated in feet, inches, and eighths of inches, and the reading seen at the tank base corresponds to the oil level.

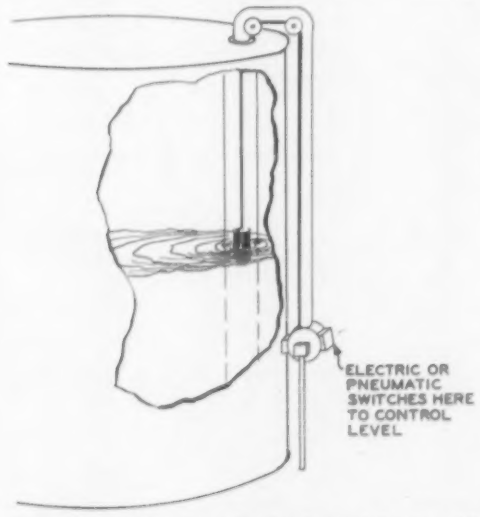
The accepted figure for accuracy of float-type gages is ⅛-in., but any properly installed and maintained gage will beat this. The practical accuracy is about 1/16-in. For level changes smaller than this, the float-type gage will not be able to follow because of friction in pulleys and gears.

Either electric or pneumatic switches can be operated by cams driven by the tape reel. This gives the float-type gage the ability to stop filling action, start and stop pipeline runs, etc. Due to the large gear reduction, accuracy of this type of switching arrangement is probably not as good as accuracy of the basic gage in showing level.

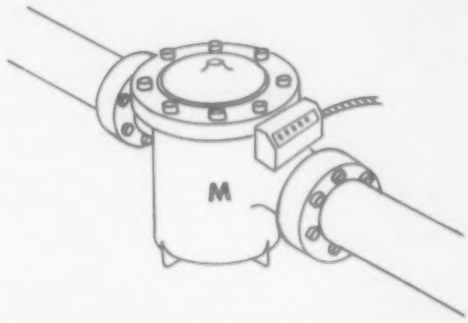
Some automatic-custody-transfer schemes will use only tank gages to set fill and drawdown levels in measurement tanks. In others, float-type gages will set the "rough" levels, while a weir is used to set final levels. In such use, the tank-gage switch, wired to the tank-fill valve, will stop filling action when the oil level reaches a preset level above the weir. As the tank is emptied, another tank-gage switch will throttle the tank outlet as the lower level is approached, letting a bottom weir set the final level.

Whether the float-type gage does all the controlling of level or only sets the rough levels, it provides a convenient ground check on the tank's level. For this reason, tank gages will continue to be installed on many production stock tanks which use other means of level control.

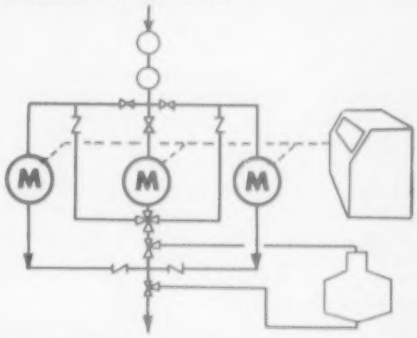
Positive displacement (p.d.) meters are the darkhorse for volume measurements in automatic custody transfer. The few companies that now have test installations consider them a coming thing as crude producers and pipelines gain confidence and experience in their use. They have a definite cost advantage over dump tanks for new installations, their accuracy is sufficient, and maintenance requirements aren't too high.



Conventional tank gages will also be used for "rough" level control. They offer enough accuracy plus convenience of ground-level gage for checking a battery's operation.



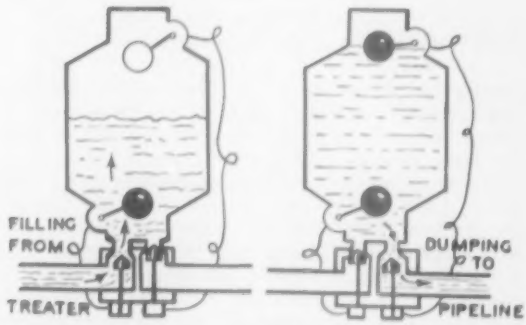
P.d. meters, temperature compensated, are the dark horse for automatic custody transfer.



Typical bank for a big lease will have its own master meter and prover tank, plus totalizing and printing equipment. Smaller leases will use a single meter with provisions for periodically placing a master meter in series for calibration.

Ultimately p.d. meters may lead the way to operation of some leases entirely without stock tanks. And, in some cases, meters will allow energy now wasted in wellhead chokes to be used for moving oil through pipeline gathering systems—keeping an entirely closed system.

Even where p.d. meters will merely measure crude from stock tanks, at least one open tank will be eliminated, thereby reducing evaporation losses.



Small dump meters are a possibility. Necked-down sections assure accuracy; they can be sized for large volumes and may be used in same way as p.d. meters.

Three types of meters are used for crude oil—sliding vane, rotary bucket, and lobed impeller. All will give accuracies of .05 to .15 per cent of throughput when properly maintained, calibrated, and used within 30 to 100 per cent of maximum range. Temperature compensation can be made automatic so meter reading is in net barrels at 60° F.

Volume ratings of meters range from a few barrels per hour to several thousand. There is also a wide range in pressure rating.

Extras . . . You can't get by with just a meter alone. First of all, while the transfer is being made, the meter must have a minimum head of oil so gas won't form in the meter case. This may require a small pump plus a backpressure valve downstream from the meter.

Then, a strainer with 20 to 40-mesh screens must be provided to keep out rock, welding slag, etc. Any sand in the produced stream will damage the machined fit of the meter so settling tanks will be needed. In addition, an air and gas eliminator must precede the meter because a slug of gas will register just like liquid.

Some means of calibration must be provided. The simplest method of doing this is to install a flanged spool in series with the lease meter and periodically place a master meter in series for short checks. But for big leases, some companies are figuring on using as many as three meters in a bank, sized so that two can handle the flow. The other will be a master meter piped to a prover tank. Manifolding will allow it to be placed in series with either of the other two.

Counter systems available range from simple, single-meter registers to complex totalizer schemes with ticket printers and backward counting registers which will shut the lease down when production quota is met.

Dump meter . . . The type of meter now widely used for well testing may play a big part in automatic custody transfer. This is a small-capacity dump tank with necked-down sections at top and bottom. It is quite similar to a pipeline meter-prover tank. High and low levels are controlled by movements of floats within the necked-down sections. And, since the change in volume-per-unit distance in the necks is small, overall error in measuring volume is held down. Accuracy of the dump meter is about like that of the p.d. meter.

The meter handles only small volumes at a time, but the rapid dumping action gives capacities up to 200 bbl. per hour. This is plenty for most automatic-lease installations. A counter on the meter records each dump, either in barrels or number of dumps.

TEMPERATURE MEASUREMENTS

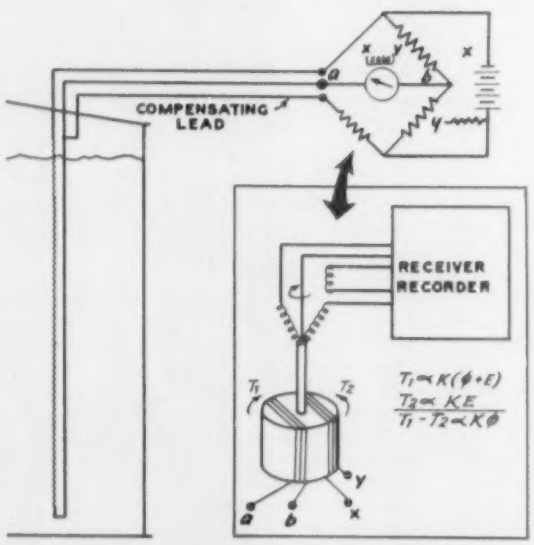
DETERMINATION of temperature of oil in lease tanks presents no great problem in designing for automatic custody transfer. The only question is whether producers and pipelines will be content with spot temperature readings, as now done in hand testing, or will require a more accurate averaging method.

The spot method involves taking temperature readings at three or more levels within the tank, with the average of these readings being accepted as the average temperature of the oil. The averaging method uses a long temperature-sensitive element that hangs vertically in the tank and extends from the top oil level to the low level.

Either electrical or pressure-bulb elements can be used for both spot or averaging temperature measurements. Whichever method is chosen, results will be more accurate than with today's hand methods.

Temperature recording . . . Whatever temperature-measuring system is used, readings will be recorded at specific times in the operating sequence if dump tanks are used. Assuming an immediate and rapid withdrawal from the tank, the only temperature that counts is that taken just before the pipeline gate is opened. But in some cases, another temperature reading will be required on oil left in the tank after the pipeline run is over. This closing reading will guard against errors in volume calculations caused by drastic changes in ambient temperature during the run.

If a printer-type recorder is used, the sequence control system will cause temperature to be recorded just prior to opening of the pipeline valve. With a pen-type recorder, a little more is involved. The electrical drive for the recorder chart will normally be locked out until just before the pipeline gate is due to open.



Basic circuit of one electrical averaging thermometer, showing ambient compensation lead and detector with double coil to compensate for changing battery voltage.

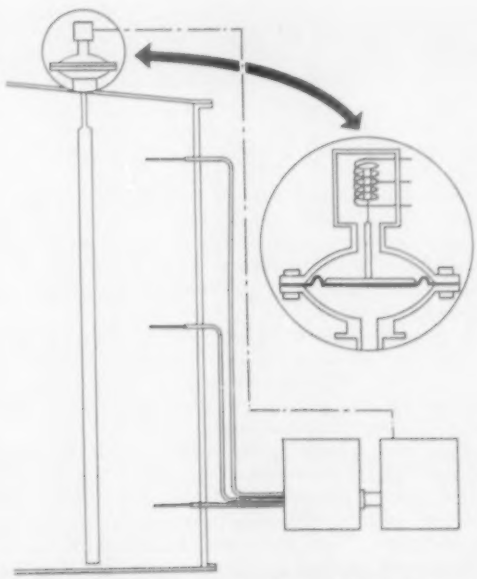
Thus, the recorder pen will drift back and forth across the chart due to normal variations in temperature of the oil over any extended period of time. But the chart won't be moving, so the pen will only record a single line perpendicular to the usual recorded line. Then, at the proper time in the sequence, the chart drive is energized and the pipeline gate opened. The proper temperature to use for volume calculations is that value shown just as the chart starts moving. As soon as the run is complete, the chart drive will be deenergized.

Electrical Methods

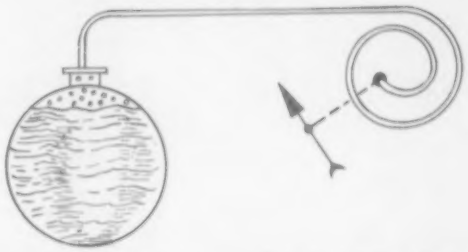
Average-resistance method . . . The fact that a metal's electrical resistance changes with temperature forms the basis for averaging thermometers. For lease tanks, a single resistance element long enough to extend from the highest to the lowest oil level is hung vertically in the tank. Its resistance is then measured by a modified Wheatstone-bridge circuit and is recorded directly in °F. Power can be either battery or rectified a.c.

Since the resistance element is sensitive along its entire length, it in effect takes an infinite number of spot measurements. The reading, then, is the true average temperature of the column of oil around the element. Use of an averaging bulb, whether electrical or pressure, is undoubtedly the nearest approach to getting true average temperature that the industry has. Its major drawback is that it cannot take into account the changes in temperature laterally across a tank. But with a bulb near the tank center, this factor is partially compensated for.

Spot measurements . . . From an instrumentation standpoint, spot temperature measurements are similar to the averaging method. Three or more small resistance elements or thermocouples are placed at different heights inside the tank about 18 in. from the shell. Leads are brought through the shell and connect the elements with a suitable bridge and recorder. A selective switching mechanism allows one bridge to measure temperature of several resistance elements.



Pressure-bulb thermometers can be used for both averaging and spot measurements.



Basic principle of any pressure-bulb system is that liquid expands or its vapor pressure increases with heat.

Thermocouples can also be used for spot temperature measurements in much the same manner as spot resistance elements. The detecting circuit is a self-balancing potentiometer instead of a bridge because the electrical quantity is an e.m.f. instead of a resistance change. For lease-tank operation, copper-constantan thermocouples have adequate range, and commonly used circuits will produce accuracies of a fraction of a degree.

Where closing temperature readings are also required, it is a simple matter to place an additional thermocouple or resistance element below the pipeline connection.

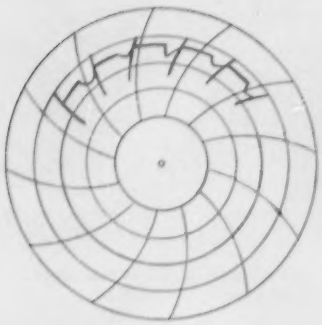
Electrical circuits . . . Bridge circuits used with the electrical device are designed so that effects of ambient temperature and supply voltage changes are eliminated. Whether a self-balancing or deflection-type bridge is used, a temperature-compensating lead is run in parallel with the lead from the bridge to the resistance element in the tank. This extra load is placed in the opposite arm of the bridge from the measuring element lead. Since any change in ambient temperature affects both leads similarly, their resistance ratio remains constant.

Changes in supply voltage have no effect on self-balancing bridges because no current flows in the detector circuit at balance. But in nonbalancing circuits, fluctuations in supply voltage would cause serious inaccuracies if uncompensated. This is done by winding an extra coil on the movable core of the deflecting element.

This extra coil is connected through resistors directly to the bridge supply. It produces a torque on the detector's movable element that is opposite to that produced by the coil connected directly across the bridge. Thus two torques are produced in the movable element at all times. One torque is proportional only to supply voltage; the other is proportional to temperature of the measuring element and to battery voltage. Since the torques are in opposite directions, the resultant is dependent only on temperature.

Pressure-Bulb Thermometers

The familiar mercury-cup-case thermometer is merely one form of a pressure-bulb instrument. And the present hand-gaging method is a spot temperature measurement. But pressure bulbs can also be designed to give average temperature, just as the electrical-resistance element does.



Use of a recorder chart energized just as pipeline gate opens is a simple means of getting the right temperature of oil for volume calculations. This also gives another check on the number of tanks dumped.

Pressure-bulb thermometers work on the principle that a fluid expands when heated. Thus, temperature systems using pressure bulbs consist of a bulb filled with a fluid, connecting tubing, and a movable element sensitive to pressure changes. The bulb may contain liquid, a liquid and its vapors, or just gas. The movable element can be a diphragm, a bellows, or a bourdon tube (the latter is most common). This element is suitably linked to a stylus for direct recording or to a transducer (either electrical or pneumatic) for transmission to a remote recorder.

For automatic batteries using spot temperature readings with pressure bulbs, three bulbs installed laterally in the tank at different heights will be required, just as with electric spot elements. With a recorder close to the tank, these bulbs will be connected directly into the recorder.

If the recorder is several hundred feet away, some form of transducer will be used—e.g., a movable-core differential transformer. Recorders will be three-pen instruments if hooked directly to the measuring bulbs near the tank. If electrical transmission is used, recorders can be single-pen instruments or a multiple printer, using a switching arrangement to record each temperature measurement in sequence.

If a closer approach to average tank temperature is required, the pressure-bulb system isn't at a loss. Use of a gas-filled bulb long enough to extend from the high to low level of the oil is all that's required. Besides giving a better average, this method will eliminate a step in calculating volume—that is, manual averaging of three temperature readings.

Ambient compensation . . . Both gas-filled and mercury-filled bulb systems require compensation for different ambient temperatures at the bourdon tube. This is done in a variety of ways, but essentially consists of an element in the case which tends to move opposite to the measuring spiral with a change in ambient. The forces developed exactly cancel, and ambient changes have no effect.

With the mercury system, compensation must be provided for changes in ambient along the connecting tubing. This is done by running a second capillary tube from the case to the measuring bulb. This tube is deadended at the bulb and connected to the ambient compensating element in the case. Changes in ambient along the two tubings act in opposition, again canceling.

Tank installations . . . The specific type of tank installation needed depends mostly on whether averaging or spot readings are made. With spot measurements, there is little choice. The sensitive elements are installed horizontally through the tank shell, with the sensitive portion at least 18-in. from the shell. With averaging bulbs, the designer has more flexibility. The obvious choice then is to place the bulb as near the tank center as possible.

GRAVITY MEASUREMENTS

AN ACCURATE measurement of gravity is particularly important in crude-oil transfers because unit price of the crude depends on its gravity.

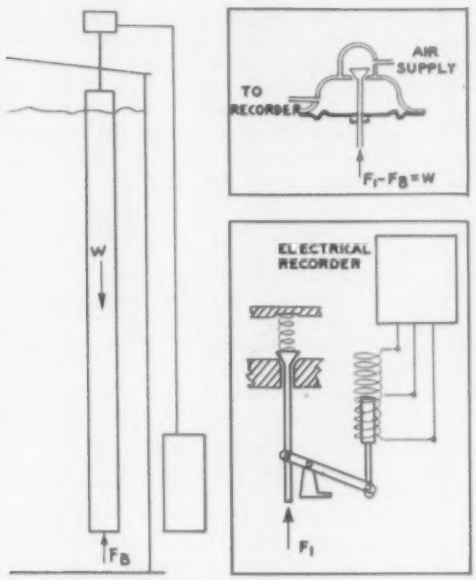
In West Texas, a difference of 1° A.P.I. means a difference of 2 cents per barrel in price. In California the spread is greater—up to 8 cents for 1° A.P.I. The breaking point for price changes is at the even-degree mark (i.e., 30.0-30.9° oil brings one price, 31.0 to 31.9° A.P.I. oil another). Hence a sensitivity of at least 0.1° A.P.I. and preferably 0.05° A.P.I. is required of the gravity-measurement system.

Automatic determination of average gravity is possible if dump tanks are used. The leading method now being considered for this is measuring force exerted on a submerged cylinder in the oil. But if p.d. meters measure volume, a record of instantaneous gravity only is possible with present gravitometers which actually weigh a portion of the flowing stream. Thus, all early setups using meters will need automatic samplers so that manual testing with a hydrometer can be done for gravity determination. Many companies using dump tanks for volume will rely on manual testing for gravity.

Since gravity measurement is basically a weighing process, several methods have been tried or suggested for automatic transfers. Primary among these is the measurement of force exerted by a submerged float. Another, the well-known gravitometer, actually weighs a known volume.

Suggested methods include use of a differential-pressure instrument and use of gamma-ray sources and detectors. This last method has been used with some success on products pipelines for showing interface passage by gravity change.

Time for making gravity measurements in dump-tank operating sequences will vary according to crude characteristics. Theoretically, it should be made at the same time as temperature and just before the pipeline gate is opened. This will allow correction of the observed gravity reading to true gravity at 60° F. This temperature correction will sometimes be made manually, by reference to tables, and sometimes automat-

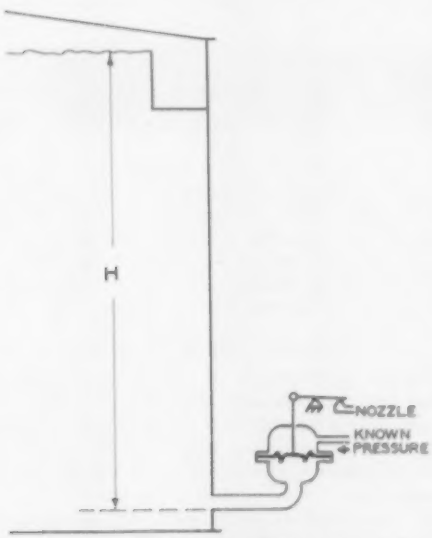


Buoyancy method (left)—A long float submerged in the oil and connected to force-sensitive transducers will be used by many to measure gravity with dump-tank method. Pneumatic type (top, right)—As float moves up, needle valve opens and air pressure increases on diaphragm, repositioning the float. Recorded pressure is proportional to gravity of liquid. Electric transducer (bottom, right)—Float movement is restricted by spring. Movement detunes differential transformer in proportion to liquid gravity.

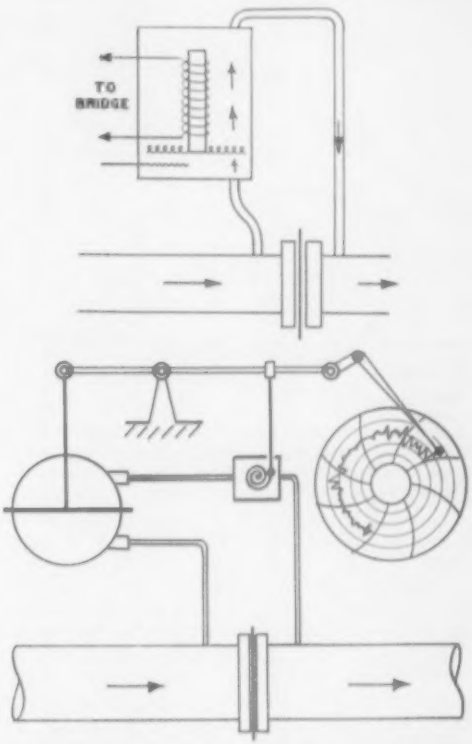
ically by the lease instrumentation. In the latter case only, the true gravity at 60° F. will be recorded.

Buoyancy Method

This takeoff from the manual-hydrometer method will be the most widely used automatic method. It offers accuracy, simplicity, and uses standard forms of electric or pneumatic instruments.



Since H is constant, it is possible in theory to use pressure measurement for gravity determination. Sensitive differential-pressure cell might be applied.



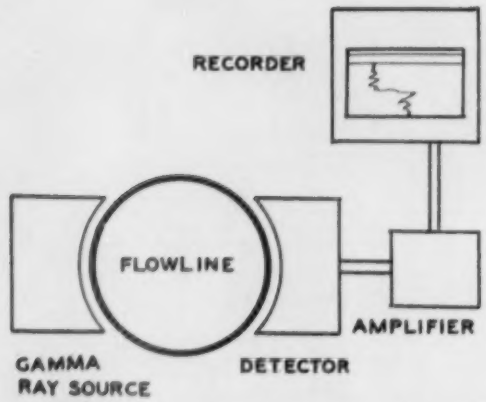
Two possible methods for continuous gravity measurement. One actually weighs a small sample. The other measures buoyancy on float submerged in chamber through which portion of stream flows. For average gravity of a batch, both would have to be recorded as a function of flow, then integrated.

A long cylindrical float is placed in the tank so as to be fully submerged when the liquid reaches its final upper level. Mechanical linkage connects the float to a force-sensitive element on top of the tank—usually an air relay of the force-balance type whose output air pressure is proportional to the force exerted by the float. Another method will use a restraining spring and measure the small distance which the float is allowed to move, converting this to an electrical signal.

In either case, the signal is proportional to uncorrected specific gravity. This is compensated for temperature by a signal from the temperature-measuring system and then converted to degrees A.P.I. at 60° F.

A float with a length equal to about 90 per cent of the distance between high and low levels in the tank will be used to give a true average gravity. The diameter must be large to get needed sensitivity. For example, the force exerted by a 10-ft.-long, 6-in.-diameter float in 30°-A.P.I.-gravity oil will change about .04 lb. with a gravity change of 0.1° A.P.I.—not much, but a change large enough to be easily measured by sensitive instruments.

Differential-pressure method . . . Since dump tanks will have a fixed head of oil at the time property measurements are made, the weight of this head is directly proportional to specific gravity. Thus it is possible



A possibility for the future is use of radioactive source and detector. Intensity of radiation reaching detector depends on density of material in line. Method is not sensitive enough at present.

in theory to use a differential-pressure cell to measure gravity.

Though the pressure change is small for a 0.05° change in gravity, it can be measured with a narrow-range differential instrument of the bell housing type.

This and all other gravity measuring systems must be carefully selected for the range involved. Sensitivities of 0.05° A.P.I. can not be expected in an instrument of wide range. So a range of 5° to 10° A.P.I. will be used in most cases.

Continuous measurements . . . As far as is known, no present continuous-reading instrument will give average gravity over a period of time of a batch. Recording gravitometers used for years on pipelines give only an instantaneous reading, not proportional to flow but to time. Thus, if gravity varies, a composite sample is needed for manual testing.

One gravitometer actually weighs a small known volume of the flowing stream which is continually bypassed through a pressuretight container. The container and its contents are supported on a knife-edge balance with the recording pen linked directly to the balance arm. Temperature compensation is provided by a bimetallic coil in contact with the fluid and acting on the balance arm. Chart ranges as low as 15° A.P.I. gravity allow interpolation of readings down to 0.1°.

Another gravitometer uses a submerged float in a small chamber through which the oil flows. Position of the float, partly restrained by a chain, is detected electrically and translated into a pen movement which records directly in degrees A.P.I. gravity. Temperature compensation allows recording of gravity at 60° F. Like the weighing type, it will not give a reading of average gravity of a batch.

For any continuous-measuring gravity instrument to give readings in average gravity, flow must be taken into account. One suggested method is to drive the instrument chart with impulses from the flow meter, then integrate the chart with respect to flow to get an average.

Other possibilities . . . A gamma-ray source and detector can be used to measure gravity, but the method is not sensitive enough at present. Working principle is that received intensity of radiation depends on density of material separating the source and detector. With oil under test as the separating medium, the reading is a direct function of gravity. However, instruments so far used on pipelines and in process plants are sensitive on only about 1° A.P.I. gravity under ideal conditions. Refinements in technique may make this a feasible method in the future.

Automatic recording instruments working on a centrifugal force-constant speed principle have been considered. But they are regarded as being too complex for long-time field use.

B. S. AND W. MEASUREMENTS

BESIDES volume, measurement of b.s. and w. is the most important test made on oil at the lease. It determines deductions from gross volume to get net volume for which the producer will be paid. It is particularly important to pipeliners who have stringent requirements on quality of oil acceptable for shipment.

At this stage, no one proposes to measure b.s. and w. content automatically for accounting and deducting purposes. This will still be done manually by grinding out sample drawn from each tender. The automatic measuring instruments will be monitors only—being sure the oil is merchantable before it enters the pipeline.

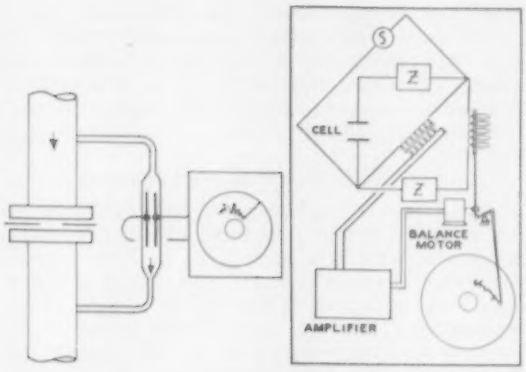
At least two acceptable b.s. and w. monitoring systems now exist. The first determines quality by measuring the dielectric constant of crude oil passing between two plates of a capacitor. The second method uses the differential pressure between columns of filtered and unfiltered oil.

Both have a narrow range of operation to get needed sensitivity. Full scale will not exceed 5 per cent b.s. and w. But oil with over 1 and sometimes 2 per cent b.s. and w. is not acceptable anyhow, so this is not objectionable. Both instruments are suitable for control of valve switching and for driving recorders.

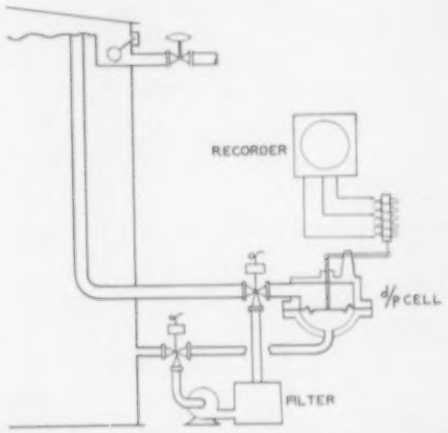
Dielectric Constant Method

With the development of this device the industry had the first radically different method of measuring oil properties in 35 years. It is so different that acceptance has been slow. But now the capacitance method promises to play a big part in automatic custody transfers.

The instrument responds primarily to water content, being affected only slightly by different grades of oil or different amounts of other impurities. This is fortunate in one respect, since pipeliners are most



Capacitance-type b.s. and w. monitor (left) continuously measures dielectric constant of liquid flowing between two plates. Capacitance cell (right) formed by plates and flowing liquid is placed in one arm of a.c. bridge. Bridge is continuously balanced by motor driven by amplifjed signal from detector coil.



Differential pressure between filtered and unfiltered heads of oil is one way to measure b.s. and w.; has advantage that all impurities are measured, not just water.

interested in water content of oil entering their lines. But it raises a minor objection to those who want a measurement of all impurities.

Another objection to earlier instruments of this type was that calibration depended somewhat on salt content of the entrained water. This has now been overcome, and present devices measure only the dielectric constant of the sample and disregard electric losses caused by salts or other impurities.

Capacitance instruments consist of a capacitance cell in the pipeline, an electronic oscillator, a self-balancing bridge, and a recorder.

The cell is formed by one of several methods: two concentric cylinders, two parallel plates, two rod-type probes, or a single probe using surrounding piping as the other electrode. Crude oil under test flows between the electrodes and acts as the dielectric.

One design allows placing the cell directly in a flow line and measurements are made on the complete flowing stream. Other designs use a small pump or orifice to bypass part of the stream through a sample chamber containing the capacitance detector cell. Vertical flow through the cell is desired by some designers to guard against debris settling around an electrode (during low-flow periods) and causing error.

The instrument actually measures capacitance of the cell composed of the electrodes and dielectric. This measurement is a direct function of the oil's dielectric constant, which in turn varies according to water content. Dielectric constants of most oils are about 2, while that of water is near 80. This 40 to 1 ratio leads to great sensitivity. In fact, some instruments will indicate a change in water content as low as 20 p.p.m., though such sensitivity is unneeded for automatic battery operation.

The bridge circuit used in one instrument has the capacitance cell in one arm, a tunable coil in the opposite arm, and two fixed impedances. A reversible split-phase motor moves the coil's tuning slug. A signal proportional to the bridge unbalance, and hence the cell capacitance, is amplified and used to drive the motor. The tuning slug is linked to a pen arm for recording.

Calibration in per cent of water of a given oil sample is linear and easily made. Readings can be made to 0.1 per cent water content with standard field instruments. Laboratory and field tests by users of several different types of capacitance instruments show they are more accurate than hand testing methods in showing per cent water.

Accuracy and sensitivity of the instrument are unaffected by pressure. Changes in temperature do change the dielectric constants of oils so temperature compensation is provided.

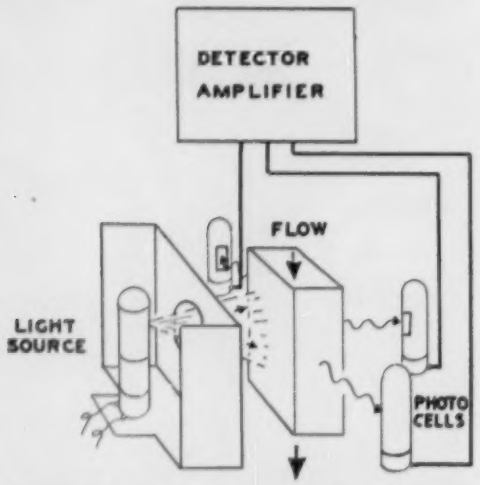
Differentiol-Pressure Cell

Use of the difference in pressure developed by columns of filtered and unfiltered oil gets around some objections to the capacitance cell since all impurities are measured. But it introduces other problems. Very small differences are involved, necessitating sensitive, delicate instruments. In addition, the measuring system is more complex and will probably require more maintenance.

To be used only with dump tanks, the system requires a small vertical pipe within the tank, open ended at the exact level of the weir lip. When the upper drawdown level has been reached, a small pump at the base starts pumping oil from the tank through a filter, discharging through the vertical tank line. After a preset purging time, the vertical line contains only filtered oil—i.e., oil containing no sediment or water. (A good filter removes water just as it does solids).

Then the head developed by this filtered column is compared to that of the unfiltered oil in the tank. To do this, a sensitive differential-pressure cell is automatically connected to the vertical pipe and to another line into the tank. A diaphragm in the cell responds to the difference in heads. It is linked to an electric transducer or air relay which converts diaphragm position into a signal to feed a recorder. Of course, the signal can also be used to control valves in the lease piping system.

As with the differential-pressure method of taking gravity, this system must operate on very small forces. For example, a 15-ft. head of 39°-A.P.I. oil with 2 per cent b.s. and w. will give a differential of only 0.06



A possibility for b.s. and w. measurement is this scheme of comparing reflected and transmitted light. A similar method has been successful for turbidity measurements on products.

psi. So to get sensitivity of 0.1 per cent b.s. and w., the amplification of the force differential must be large and the error tolerance small.

In one company's system, this method of b.s. and w. measurement will also govern treater operation. When b.s. and w. content reaches a given amount, oil will be recirculated and more chemical dumped in the treater. During recirculation, the tank will be prevented from dumping to pipeline. Then, if the content increases to a higher preset level, the lease will shut down.

Other possibilities . . . One company has studied use of light scattering as a measure of b.s. and w. content. A thin stream of oil passed between a strong light source and a photoelectric cell will reflect and scatter light in some relation to its sediment and water content. Future work may prove this instrument valuable, but present reports are that results cannot be correlated. A somewhat similar instrument has been used quite successfully by products pipelines to measure sediment only.

Operation with B.S. and W. Monitors

From an operating standpoint, the capacitance cell has a certain flexibility that the differential-pressure-cell system lacks. The former can be located in fill lines (where it would be used for monitoring of incoming oil and control of bypass valves), in sample lines for recording after the metering tank is full, or in outgoing lines for recording during the pipeline run. By its nature, the differential-pressure cell is limited to use at the time the metering tank is full.

Some arrangements will require two measurements to be made on b.s. and w. Monitoring will be done while the tank is filling, and then impurity content of the outgoing stream will be recorded. One such plan calls for a single b.s. and w. capacitance cell to be mounted in a common-tank fill-discharge line. During tank filling, it will monitor the stream and control a three-way valve so as to bypass bad oil back to the treater. When the pipeline run starts, the same cell will record b.s. and w. content.

This arrangement is objectionable to some operators who want discharge and fill lines completely isolated from each other. In such cases, two capacitance cells can be used, one in each line. A single amplifier and bridge unit can be switched to the proper cell by the lease sequential control system.

Another arrangement uses one cell to monitor and divert during filling and another to spot check a small sample for the record. A sample is automatically drawn from three points in the metering tank before the pipeline run starts. It passes through the capacitance cell and the water content is recorded. No recording is made during the actual pipeline run.

SAFEGUARDS AND ACCESSORIES

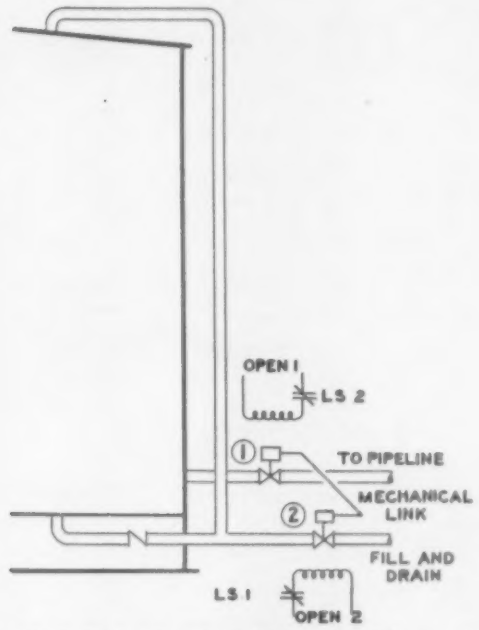
THE designer of an automatic tank battery isn't nearly through after he's picked equipment for measuring the four basic crude properties. He then has to work out the many small details that will make the operation acceptable for automatic custody transfer. Also, malfunction of equipment must be considered because the installation will operate for long periods unattended. So the design must be fail-safe.

Safeguards

Uppermost in minds of pipeliners and producers is assurance against false readings or false operation of the automatic equipment. If a dump tank is used, it must be designed to prevent simultaneous filling and emptying. With designs using a common fill-discharge line, this will be done by using a three-way or four-way valve which permits flow in only one direction at a time.

If separate fill, drain and pipeline connections are made and mechanical interlocks on the valve operators will do the job. Both producer and pipeliner must be protected. That is, the fill-line valve must be interlocked with the pipeline valve to prevent withdrawal while the tank is filling. Then the tank drain line must be interlocked to prevent draining during the pipeline run. Besides mechanical linkage, electrical and pneumatic interlocks in the control system will be used. Metal seals on the mechanical linkage will show signs of any tampering.

In almost all cases, controls, instruments, and recorders for the lease operation will be grouped in an instrument shack or box which will be securely locked



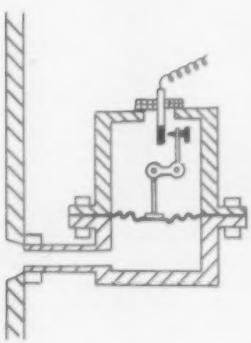
Both electrical and mechanical interlocks will be put on valves to prevent filling or draining the tank while it is on pipeline run.

and sealed. This is to keep the curious away as much as to prevent malicious tampering.

Counters which record the number of batches through dump tanks will be installed in duplicate. One system calls for a counter to be electrically energized by opening of the pipeline valve. But it is not tripped until the bottom weir switch closes. This is to guard against a count being made if something unforeseen prevents the entire tank from being dumped.

A second count on the number of dumps is afforded by a spring-driven pressure-recording chart which records changes of head pressure in the tank. The number of pips on the chart will show the number of times the tank is dumped. Still a third count will be given by recordings made of the crude-oil properties. The counter will have contacts which can be preset to shut the lease in when a daily, weekly, or monthly production quota has been met.

Level controls and switches . . . With dump tanks using weirs for fine level control, the designer isn't looking for a precision device as a level switch. Criteria will be long life under field conditions, reasonable accuracy, positive operation, low cost, and ease of maintenance. A variety of switches qualify. The main types being considered are:



Simple pressure switches, operating to ¼-in. accuracy, will serve as rough level controls.

. . . Float switches mechanically linked to and actuated by a small float within the tank. Movement of float makes or breaks contacts in a mercury tube. Under this same type is the magnetic-type switch which relies on a magnet pulling in as an iron slug is raised by a float.

. . . Tank-gage switches depend on position of a conventional tank-gage float. The switch mechanism is driven by the gage-type movement; the switch is mounted in the gage head at the tank base. Either electrical or pneumatic switches are available. Some companies will eliminate weir boxes and use only tank-gage switches as level controls.

. . . Pressure switches are actuated by heads as low as ¼ in. of water. They can be mounted directly through the tank shell or in risers beside the tank. The switches are low in cost, easily maintained, and accurate enough for rough level control.

. . . Capacitance switches have caught the eye of many designers because of accuracy and simplicity. The devices use one vacuum tube, an insulated probe within the tank, and a relay. It is cheap, simple, and designed for long life. Maintenance would consist merely of changing a tube because there are no moving parts to wear out. But the addition of an extra electronic device is objectionable to some.

Regardless of the type of switch used, most designers will put two in parallel for the high-level control—just in case.

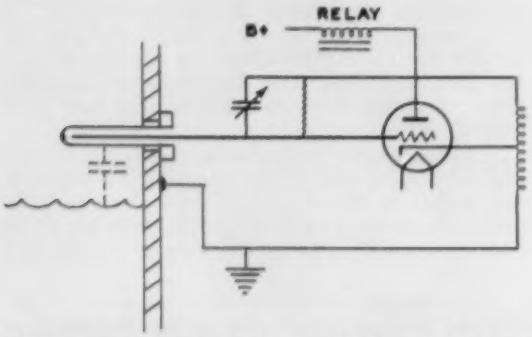
Samplers . . . Plenty of care is going into design and selection of instruments for automatic custody transfer. But these instruments won't always be infallible in measuring gravity or b.s. and w. So a final backstop in the form of one or more automatic samplers will be provided.

Some plans call for samplers to be placed on the dump tank itself. A small portion from three levels of the tank is taken at the time other measurements are made. Lines tapped into the tank at three levels feed into a common manifold at the tank base. A pump takes suction from this manifold. Since head is the same from all three levels, the proportion of flow in each sample line is the same.

The lines are purged for a preset time with the pump discharging back into the tank. Then a pressure-tight container is filled with a representative sample. Manual testing will check b.s. and w. content and gravity against readings of the recorders.

The same lease will have a sampler in the pipeline outlet, taking samples during the pipeline run. This will take a constant small volume at various intervals, the intervals depending on rate of flow. It is well established that a rate-of-flow sampler is best for this purpose. Widely varying flow rates might cause large errors in the measured quality if the sampling were done at constant intervals of time.

Several models of samplers for this purpose are available and have had wide use in the pipeline industry. Rate of rotation of propeller in the flowing stream serves as one means of governing sampling according



The capacitance switch, with no moving parts to wear out, appeals to many designers as a level control.

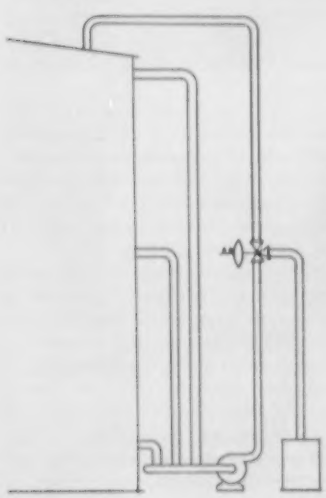
to rate of flow. Other models, both electronic and mechanical, operate faster or slower according to pressure drop across an orifice. Volume proportion of the samples drawn is in the range of 1 to 5 cc. per bbl., and size of individual samples shots may be only a fraction of this. All models have pressuretight containers for storage of the sample.

Power supply . . . Most instruments to be used for automatic custody transfer will require electrical power. If available, gas from lease separators may do some of the heavy work such as moving valves or running turbine-driven transfer pumps. But recorders, timers, sequence controllers, small pumps, and some instruments will have to have electric power.

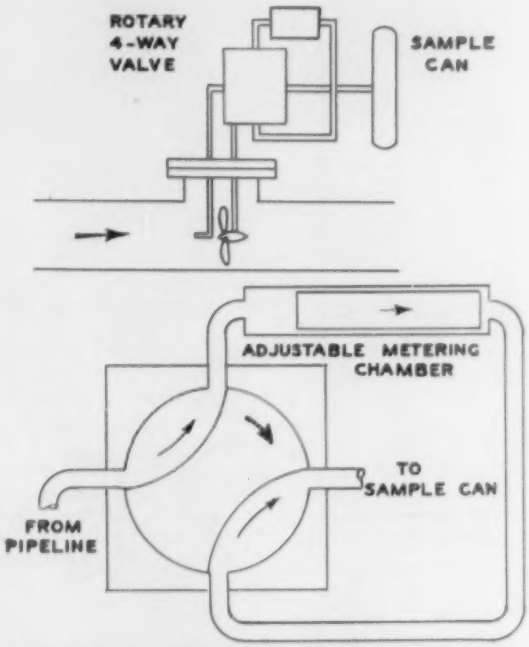
Many leases won't be near commercial power, so engine-generator or turbine-driven generators will be needed. The units will be sized about the same and have the same dependability requirements as those used as standby power units for microwave systems.

Also required will be banks of wet-cell batteries to start and back up the engine-generator set. Because of long-life and minimum maintenance requirements, the nickel-cadmium battery may be more economical than the lead-cell battery.

Data handling . . . In early stages of automatic custody transfer, the standard run ticket will still be used as evidence of a transfer being made. At first, gagers and switchers will probably have to make and sign run tickets each day just as is done now. But later composite tickets for perhaps a week's production will be acceptable.



One spot sampling method for dump-tank use will pull small samples from three levels in the tank. Lines are purged for preset time, then sample is pumped into pressuretight container.



Several devices which sample proportionally to rate of flow are available. The type shown here is all-mechanical, getting proportional action from prop in flow line. Its rotary four-way valve, driven by the propeller shaft, alternately directs flow to opposite ends of the small metering piston, and then into a pressure container.

Eventually, the manual preparation and signing of run tickets will be eliminated. Various types of instruments and printers will record daily, weekly, and monthly production data for a lease. Since exchange of property is involved, both parties interested will want a record of pertinent information. Ordinary pen-type recorders can't be made to write duplicate tickets. So some designers are thinking of installing back-to-back recorders making duplicate charts.

Others are looking at impulse-type printers which can be supplied with carbon-paper rolls. In the talk stage only, but obviously a coming requirement, is a digital recorder to be used at the lease. Data concerning each pipeline run will then be recorded on tape or punch cards. Later this will be handled by central-office computers and business machines, eliminating much more of the manual work still connected with oil accounting.

Sequence of Operations

In initial stages, designers are bending over backwards to see that each operation of an automatic-custody-transfer installation is under strict control and is interlocked with the preceding and following operation. This may change as experience is gained with basic designs and equipment. But now it seems warranted to designers because of newness.

With a p.d. meter installation, there is little to controlling the sequence of operations. A master timer causes a pipeline gate to open when the pipeline can receive the oil. Then meters and recording instruments simply record during the run. Reset counters on the meters will shut the lease in when the day's production quota has been run.

A bypass arrangement activated by a b.s. and w. cell will keep bad oil out of the pipeline. Slugs of extremely high-gravity oil may also be recirculated, depending on the pipeline requirements. Differential-pressure instruments, working across meter screens and meters, will guard against jamming a meter or clogging a screen. But these are simple requirements needing no elaborate instrumentation.

Sequential control requirements in the dump-tank method are more complex. The following is a typical operating sequence of a dump tank using some of the instruments described previously. The meter tank is assumed to be supplied directly from a treater, with one spillover tank provided as extra storage. Initial conditions are that the pipeline gate is closed and the meter tank empty with all valves closed.

1. The meter tank fill valve opens and a small transfer pump starts pumping oil from the treater into the meter tank. The fill valve is pneumatically powered with separator gas and has an electric pilot valve.

2. The meter tank fills to its high level, at which time a float switch causes the fill valve to close and the transfer pump to stop. An electric timer is energized at this time and prevents further action, allowing the tank to weather for a preset length of time depending on the crude's characteristics.

A master timer, synchronized with other pipeline operations, determines when the sequence will continue. This timer is set to operate during certain hours of the day so as to smooth the over-all pipeline loads.

3. At the end of the weathering period, if the pipeline can take the oil, a valve opens in the overflow line from the metering tank to the spillover tank. This line is connected to the metering tank through the high-level weir box and drains the tank down to the weir lip. A float switch within the box closes, energizing another timer and closing the drain valve. After a preset time delay, the drain valve opens again and the remaining oil which has drained into the weir box flows to the spillover tank.

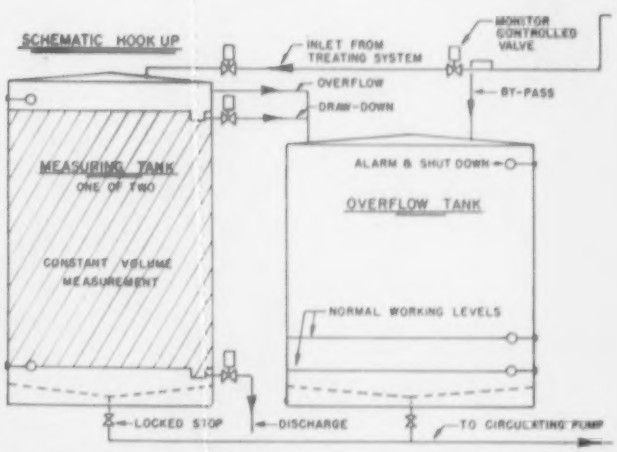
4. At this point, the upper level has been established with sufficient accuracy. Property measurements are then taken, using any combination of the instruments previously described. A sample is also taken. If the tank is not acceptable due to high water content, high temperature, or high or low gravity, the control system will lock out the pipeline valve and cause the contents to be pumped back to the treater or into a slop tank. Barring this, the tank contents are now ready for delivery to the pipeline.

5. The pneumatically powered pipeline valve then opens, draining the tank down to the bottom weir level. During draining, a continuous recording is made of b.s. and w. content and a proportionate sample is drawn from the pipeline stream. Valves in this scheme are power-to-open type. Thus a power failure will cause all valves to close. When power is restored, the operating sequence starts where it left off. If power fails during a pipeline run no erroneous count can result because the bottom weir switch has not operated to trip the counter.

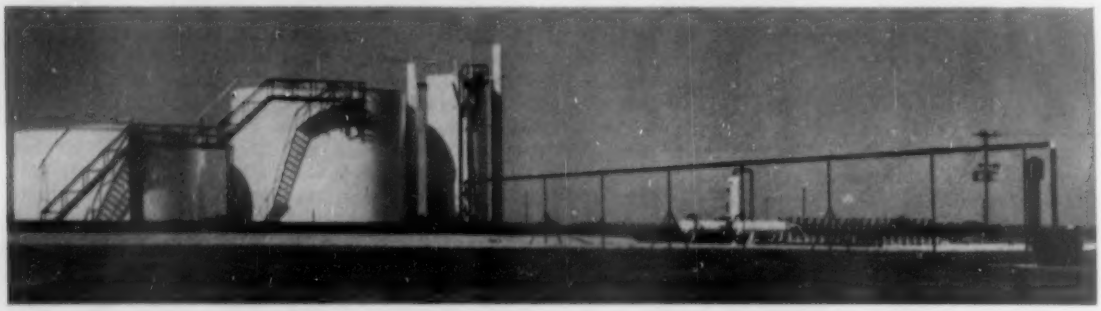
6. When the tank drains down to the bottom weir lip, a float switch within the box closes, shutting the pipeline valve and starting a timer. This timer, like the one for the top weir box, holds up other operations in the sequence, allowing the bottom weir box to partially refill from slow drainage. Then the pipeline valve is reopened, completely draining the box.

Next, the tank drain valve is opened and the transfer pump removes bottoms from the tank, pumping into the treater system or to a slop tank. The meter tank is now empty and ready to start a new cycle.

Here's first practical application of automatic custody transfer



First actual lease automatic custody transfer was from this Gulf Oil Corp. battery to Kaw Pipe Line Co. The battery is located in Kansas and is in daily operation. Parallel metering tanks, one dumping while the other fills, are used in the Gulf battery. A capacitance b.s. and w. monitor keeps bad oil from entering the metering tanks. Level is controlled by upper and lower weirs. (For complete details of design and operation see The Oil and Gas Journal, April 23, 1956, page 96.)



. . . and here's how Shell is testing in West Texas

IN Wasson field of West Texas Shell Oil Co. has made extensive tests on equipment and methods for automatic custody transfer. Two dump-tank designs have been tried. In fig. 1, these two appear as Hookup A and B. Design A was tested first, then revised according to suggestions from a number of nonaffiliated pipeline operators who viewed the operation.

The design which has been settled on is Hookup B in Fig. 1. This was covered in detail in an article in The Oil and Gas Journal of October 17, 1955, page 111. Basic features of that design are reviewed here. These are:

1. The method is based on a single dump tank.

2. A surge tank receives oil from treating equipment and delivers into the dump or metering tank.

3. The two-weir method is used for level control. A high weir controls the upper level and a bottom weir the final drawdown level.

4. B.s. and w. is continually monitored as oil enters the metering tank. Bad oil is detected by this monitor and immediately diverted by a three-way valve from the dump tank back to the treater system.

Shell's tests on the capacitance b.s. and w. detector show it to be much more accurate in showing percentage of water in oil than centrifuge methods.

5. Measurement of crude-oil temperature and gravity will be made just prior to running the tank to pipeline.

6. Samples will be drawn by a proportional sampler in the discharge to pipeline and stored in a pressure-tight container for pickup at regular intervals.

7. Means for recycling the meter tank bottoms is provided. Sample cocks spaced around the tank will allow inspection for bottom build up.

8. For safeguards the valves on fill, drain, and pipeline discharge lines will be mechanically and electrically interlocked. Seals on these interlocks will reveal signs of any tampering. Electrical controls will all be locked in an instrument cabinet.

Operation of this battery, when it actually goes into use for automatic custody transfer, will be controlled by preset timers. These will control the number of dumps a tank will make in a day, week, or month and will be able to schedule the particular time for dumping to pipeline.

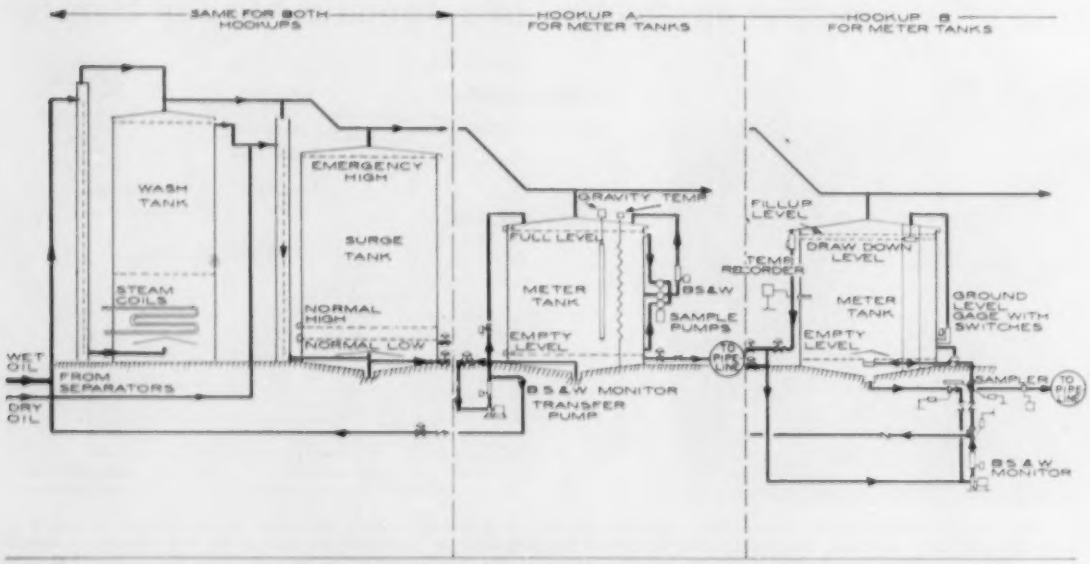


Fig. 1—Schematic of two methods tested by Shell. Method B appears the more promising for automatic custody transfer.

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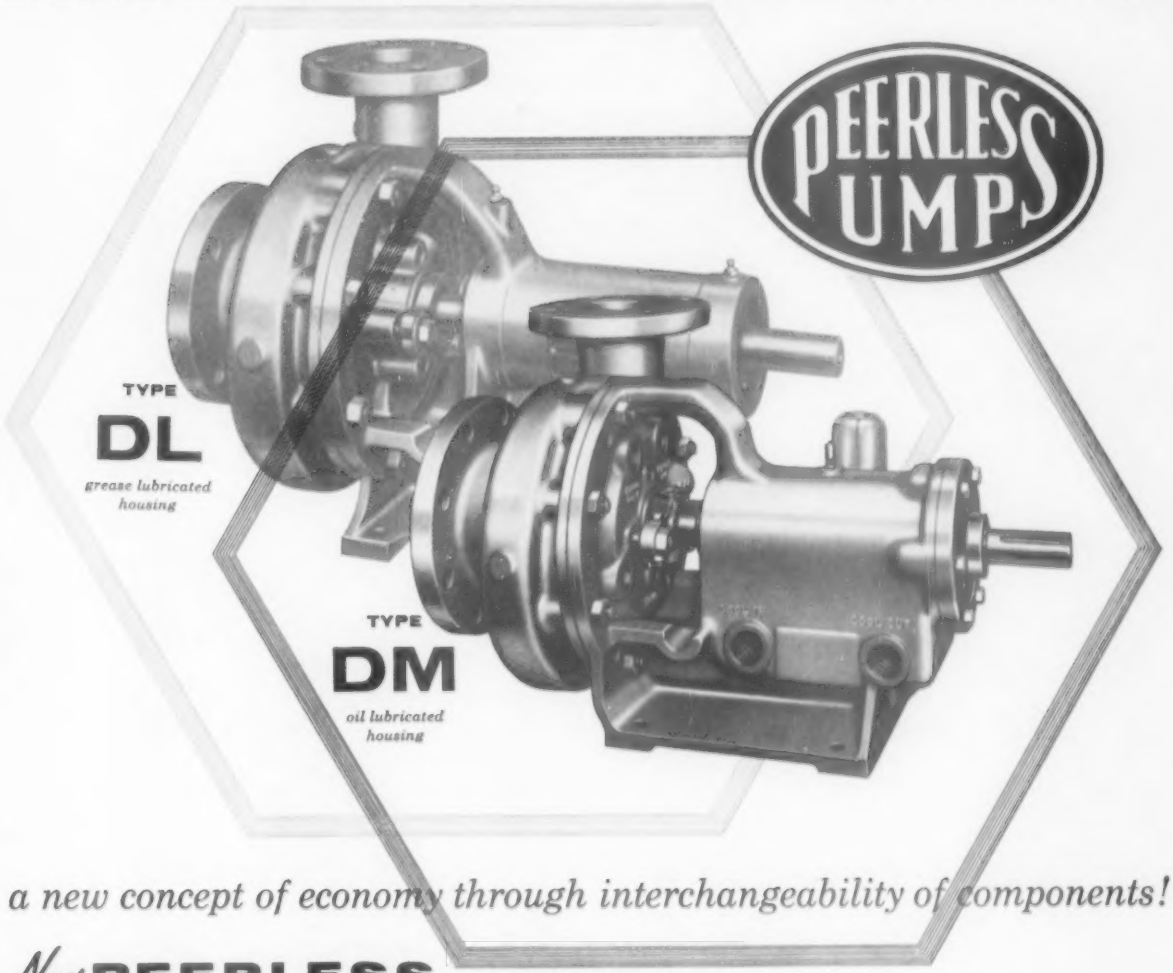

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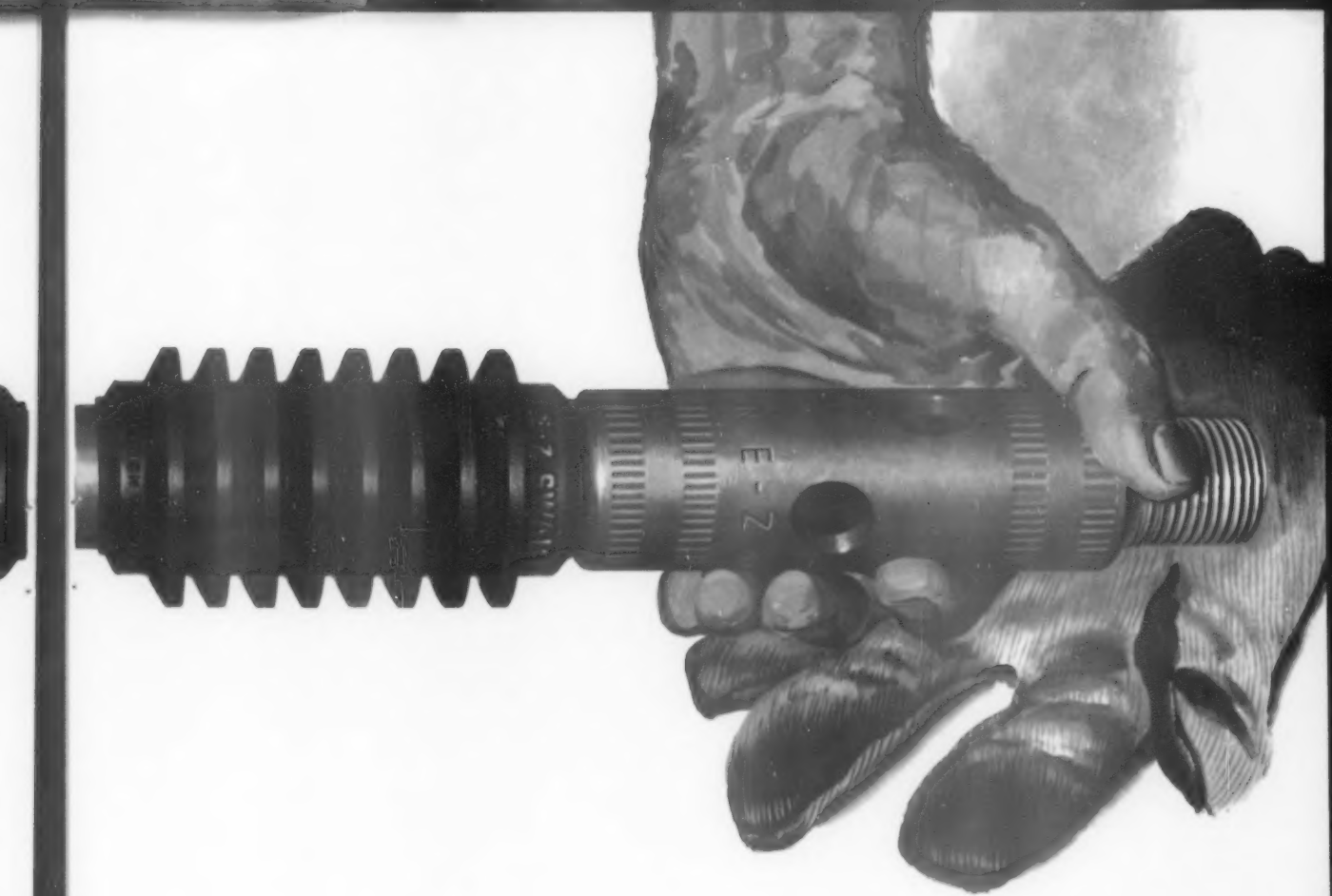

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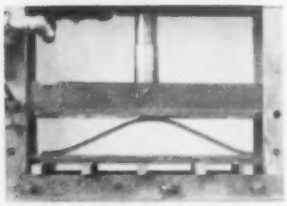
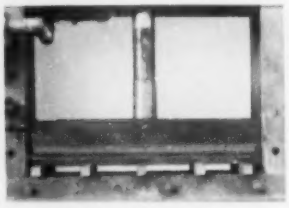
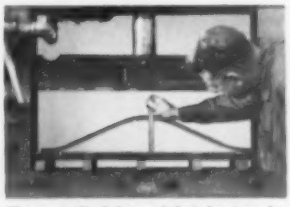


Spring in position in hydraulic press for flattening test.



The tightest hole could not flatten any spring more than this.



The specified bowed height (reach) must be present after the slight permanent set.

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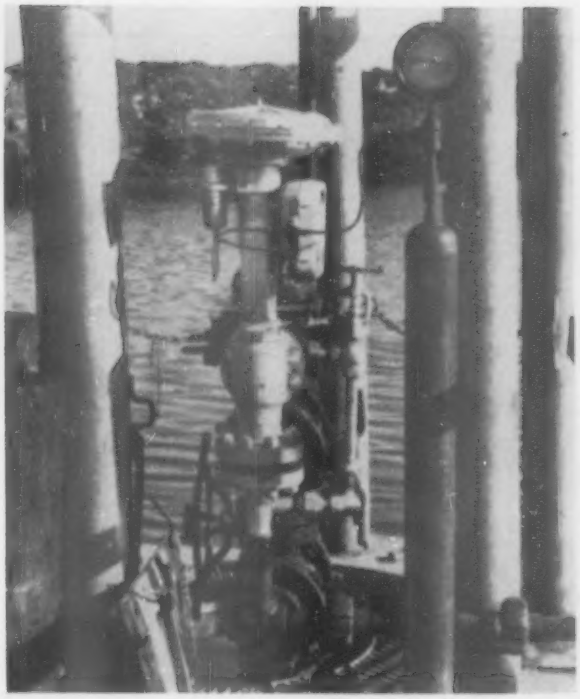
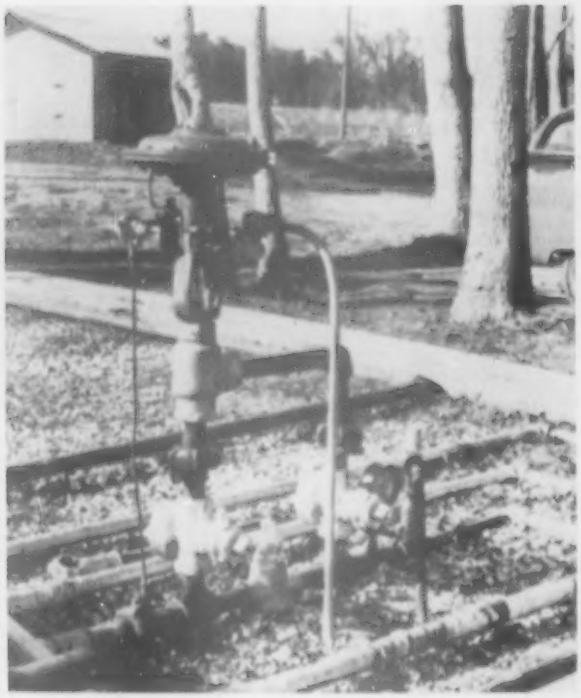
BAKER
CASING CENTRALIZERS



GAS-POWERED VALVE tested at one well at Weeks Island. Fig. 7.



GAS-POWERED VALVE installed in manifold. Fig. 8.

2. CASE HISTORY—Gulf Oil's marine tests on

Automatic Control of Production

Requirements for automatic production control of marine leases is vastly different from those onshore. Usually there is no commercial power, leases are difficult to reach, a corrosive atmosphere requires special equipment, etc. This article shows how Gulf tackled the problem at two marshland fields.

by C. R. Bayless*

AFTER initial success with automatic control of production in East Texas, Gulf Oil Corp. decided in 1952 to make tests to develop automatic controls for bay and marsh-located fields. These controls might later be extended to cover potential offshore operations.

The East Texas installations were described in Part 1 of this series *(See The Oil and Gas Journal, June 4, 1956, page 78)*. Conditions in the bay and marsh fields differed from those in East Texas in that the wells were generally of much higher pressure, the atmosphere was much more corrosive, electric power could not be supplied at the individual wellheads, and the wells did not require any shut-in time for proration scheduling.

Weeks Island field was selected for the first test because it is a small, marsh-located field with ready access to the wells and battery from a gravel road and has available a source of commercial electric power. The controls installed at Weeks Island were very similar to those installed at East Texas field, with three exceptions: first was the elimination of time cycle controllers, second was the use of new high-pressure electric control valves, and third, a pneumatic well-shut-in valve was used to eliminate the need for electric power at the wellhead.

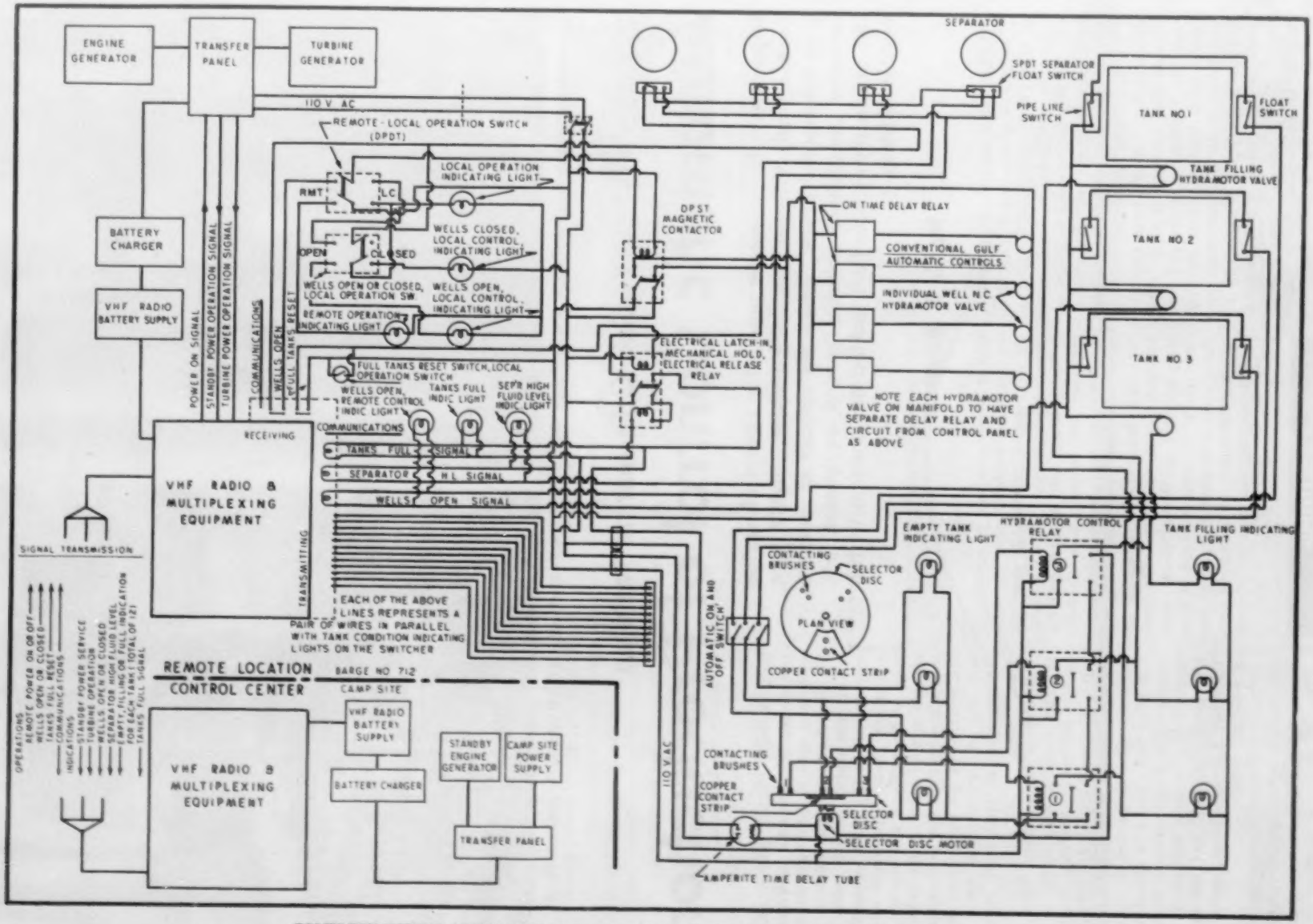
This last-named feature, tested on only one of the five wells, consisted of a high-low shutoff diaphragm control valve at the wellhead and another diaphragm control valve at the tank-battery well manifold. The wellhead valve was powered by gas from a trap in the flow line and the manifold valve was controlled by an electrically actuated pilot.

Should the tanks become filled, the switcher would send a signal to this electric pilot and close the manifold valve. Pressure building up in the flow line against the blocked valve would cause the valve at the well to close in. The other wells would be closed in by electrically operated valves at the wellhead. This pneumatic well shut-in system proved practical and led to the Timbalier Bay installation, which will be described later.

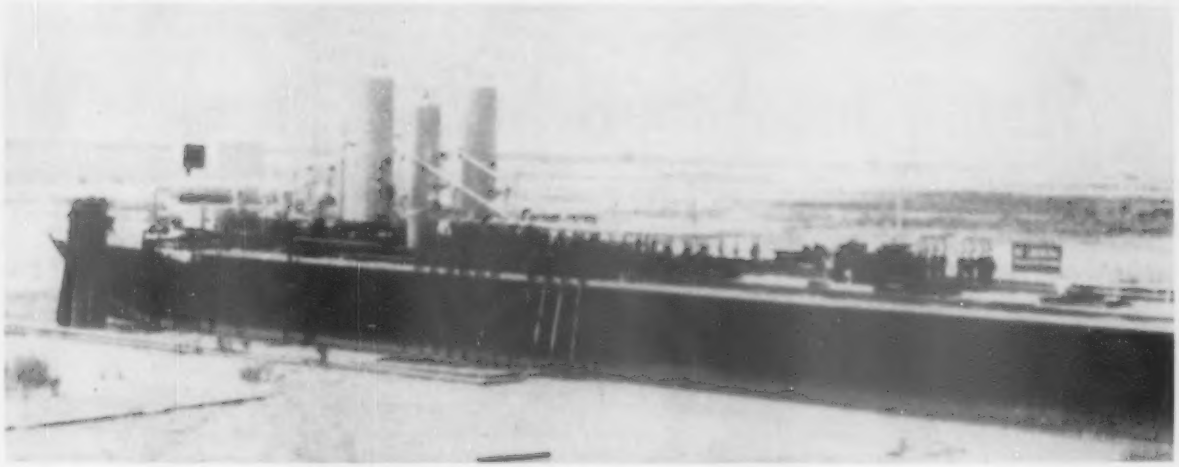
Figs. 7 and 8 are photographs of the well shut-in valve and the manifold shut-in valve tested at Weeks Island.

The system is still in operation and

*Deceased; was formerly division engineer, Gulf Oil Corp., Houston. Article adapted from paper delivered to Gulf's Supervisory Conference on Production at Pittsburgh, 1955.



COMPLETE WIRING SCHEMATIC of the automatic production controls used at Timbalier Bay. Fig. 9.



BARGE with production and control equipment at Timbalier Bay. Fig. 10.

has reduced operating and intangible costs by about $7,000 per year.

More details of the Weeks Island operation are given in a paper, "Automatic Lease Operations, Weeks Island Field, Louisiana," which was presented at the A.I.M.E. meeting in Dallas, October 1953.

Timbalier Bay Automatic Controls

As the Weeks Island tests established the availability of adequate tank-battery and well controls for marine areas, it was decided that a test of such controls would be made in a remote location and that such an installation would be operated from a distant location by very-high-frequency radio. Experience in this technique was desirable since the possibility of offshore production was ever nearer, with actual drilling in progress during late 1952.

Timbalier Bay field was selected for this test. It is in a bay on the edge of the Gulf of Mexico near the mouth of Bayou Lafourche in Lafourche Parish, Louisiana. About 2 miles west of the field headquarters is Louisiana State Lease 1772, which is produced into a six-compartment oil-storage barge. Separators and piping are located on the barge deck.

Conventional tank switching and separator safety controls were installed on the barge and pneumatic high-low shutoff valves were installed at the wells. Electric control valves were installed on each well flow line at the barge manifold so wells could be closed in by pressure buildup in the flow line. Power was supplied for the system by a gas-turbine-driven generator. With these controls the lease could then be operated as any lease similarly equipped in East Texas or Weeks Island.

Radio equipment, in addition to the standard equipment, and the remote radio control facilities were then installed. The storage barge was equipped with v.h.f. radio and multiplexing devices which would transmit to the field headquarters all necessary information regarding conditions at the barge. It would receive and act upon all supervisory control signals initiated at the field headquarters.

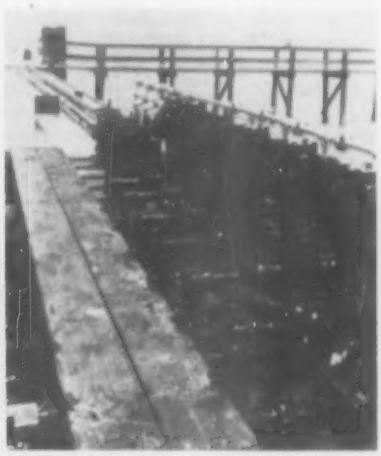
Intelligence transmitted to and from each station is in the form of audio tone sequences. These coded signals are transmitted between stations over two v.h.f. radio channels in the 72-76 megacycle band.

The barge is also equipped with a standby engine-driven generator and storage batteries. Thus operations can be resumed after a shutdown which would inactivate the gas-turbine-driven generator.

The field headquarters station is also equipped with transmitter and receiver as well as a control panel which indicates conditions at the barge. Power is supplied at this station by engine-driven generators which also supply power to other electrical equipment at the field headquarters.

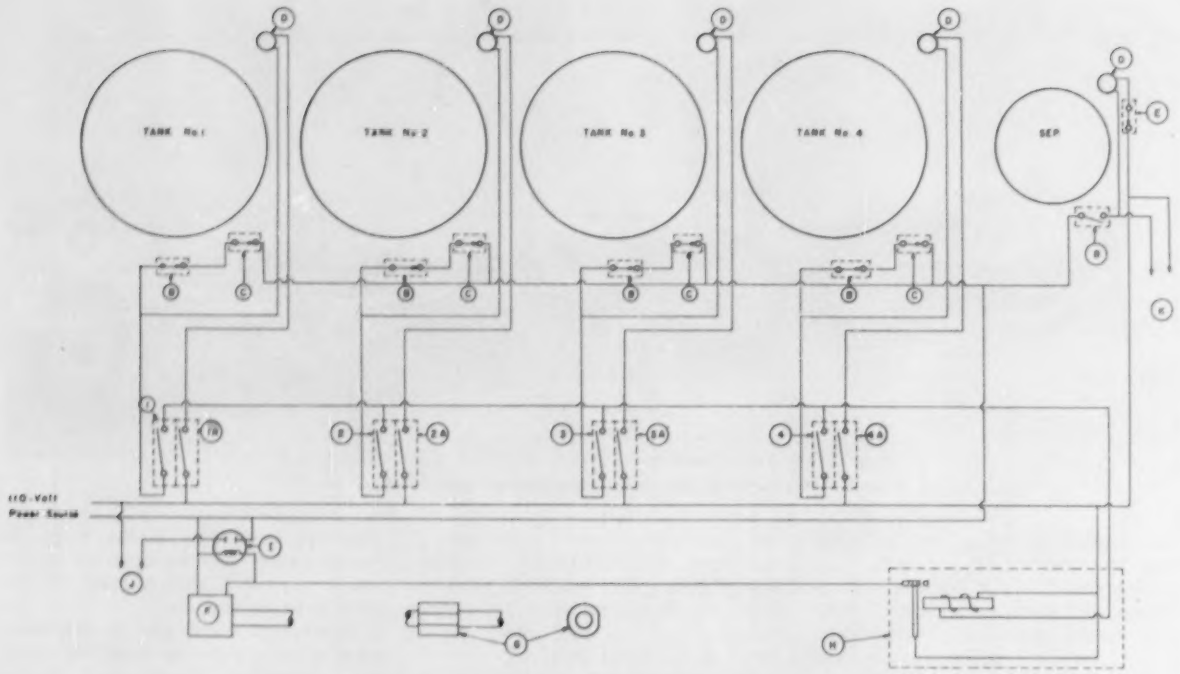
From this master station all operations at the barge can be closed in

MASTER CONTROL equipment is housed in these cabinets. Fig. 11.



WELL MANIFOLD on the production barge. Fig. 12.

ELECTRICALLY POWERED tank fill-up valves on the barge. Fig. 13.



SCHEMATIC OF TANK BATTERY using Gulf's electric tank switching scheme. Fig. 14.

Legend: 1, 2, 3, 4, 1A, 3A, 4A—Microswitches; B—Float switch; C—Pipeline switch; D—Hydramotor valve; E—Manual switch; F—Cam motor; G—Cam; H—Motor relay; I—Amperite time delay tube; J—To field relay; full tanks; K—To field relay, full separator.

and placed back in operation after a shut-in period. By manipulating the control panel it is also possible to check the conditions at the barge at any time.

Figs. 9, 10, 11, 12, and 13 show a wiring diagram and equipment photographs of the Timbalier Bay operation. Additional information on this installation may be found in papers listed in the following references:

1. "Remote Automatic Control of Oil Production" presented October 17-20, 1954. A.I.M.E., San Antonio.
2. World Oil article, "This Producing Lease Is Controlled Automatically," in the November 1954 issue.
3. "Controlling Production by Radio," The Oil and Gas Journal, March 28, 1955, page 112.

Equipment performance . . . The control system at Timbalier Bay, which has, as of December 31, 1955, 31 wells connected, has been in operation for approximately 18 months and has developed several equipment deficiencies which are now being corrected.

At the time of this installation the value of gas used to generate electricity at the oil barge was not a factor because it was flared as a waste product. When a market becomes available, however, a more efficient turbine generator than that now available will be required. A design for such a generator is now being developed with manufacturers. A smaller, more compact unit is expected to provide electric power with a large reduction in gas consumption over existing models.

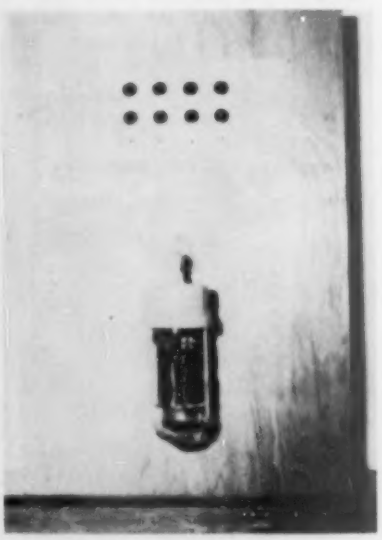
The original tank switcher has proved inadequate for the corrosive atmosphere in Timbalier Bay; however, recent revisions have been made that indicate more satisfactory operation. A new oil-immersed switcher using microswitches has been constructed by Gulf personnel and is being tested in East Texas. Figs. 14 and 15 show this new switcher.

Two types of electrically operated valves are being tested at Timbalier Bay with a price differential of approximately $300. The lower-priced model which has worked successfully at other locations is quite inadequate for this job. The manufacturer of this latter valve is now developing a new enclosed-type actuator for his valve which should eliminate the corrosion damage that has caused most of the trouble. Manual operation of the new design will also be possible.

Additional improvement in the wellhead-valve operation has also been necessary. New model flow-line gas traps have been developed and installed.

The radio part of the Timbalier Bay operation has proved very successful, requiring little maintenance. Some trouble has been encountered with the relays due to condensation in the winding. This trouble has been eliminated by replacement with a sealed coil.

It is thought that continued operation of the Timbalier control system will develop suitable equipment for such marine operations. Valuable experience will be acquired which will prove profitable in production operations in the open waters of the gulf.



OIL-IMMERSED tank switch for corrosive atmosphere. Fig. 15.

PROCESS HEATER DESIGN

Why Limit Radiant Heat Input Rates?

Some major refining companies are limiting the tube-wall temperature instead, as was originally intended. Here for refinery engineers are the reasons behind this move.

by H. F. Lassner

IN present design of radiant heaters it is customary for the refiner to set a limit on the radiant-heat-input rate. This is done, understandably, to prevent overheating of the coil and possible costly furnace shutdown.

- Both supplier and user of process heaters would be better off if the stringent limitations on radiant-input rate were omitted from specifications.
- Some of the major refining companies have, in fact, recently abandoned the practice of prescribing input rates. Instead they limit the tube-wall temperature—which is what was intended originally.
- This article is aimed at the large group of refinery engineers who are not heater experts but whose duties may involve procurement of process heaters and the necessary writing of specifications for this type of equipment.
- Earlier literature dealing with radiant flux distribution is reviewed, and the **disparity factor** is defined. An explanation is given of what the radiant-heat-input limitation means in terms of the Mekler chart which correlates the Stefan-Boltzmann equation. In this manner, a clearer understanding may be obtained by the nonexpert of the pros and cons of limiting radiant-heat-input rates.

Heaters custom built . . . First cost of heaters is a major item in any estimate for a plant. For a set of operating conditions different bidders are likely to arrive at a similar shape or size of a pump, of a heat exchanger, or of a fractionating tower. But the refinery furnace has in a way resisted the trend toward standardization.

For a given condition, various bidders may evolve widely different designs varying with regard to shape and size of the furnace envelope and to the disposition of the heating coil inside the setting. In short, process heaters are—as a rule—custom designed. And the variety possible in heater design demands a more thorough study of each individual bid by the engineer handling the purchase than is needed in buying other equipment items.

Coil exposed . . . With stream efficiency as vital as it is, refiners naturally desire to reduce the risks leading to costly furnace shutdowns. Evidently the tubular coil, which carries the fluid to be heated and which nowadays is partly or completely exposed to radiation, is the most sensitive part in a heater.

While its surface must be adequate for the heat to be transmitted to the fluid in process, the coil is expected to resist destructive action by a whole set of conditions during the economical life span of a furnace. Some of these conditions are corrosion possible on the inner and/or outer surface, erosion due to sudden change in the direction of flow in return bends or due to entrained solids, etc.

Radiant Input Rate Limited

Given all the factors unfavorable to tube life—some practically beyond the user's control—refiners aim at keeping down those difficulties that may result from overheating the coil. It is customary that in furnace specifications, the radiant input rate is limited to a specific value which the purchaser considers low enough to prevent overheating.

The **radiant rate** (also called radiant-input rate, heat density, heat intensity, absorption rate) applied to a coil is the very design value from which the outer coil surface is derived according to:

$$Q = A \times q$$

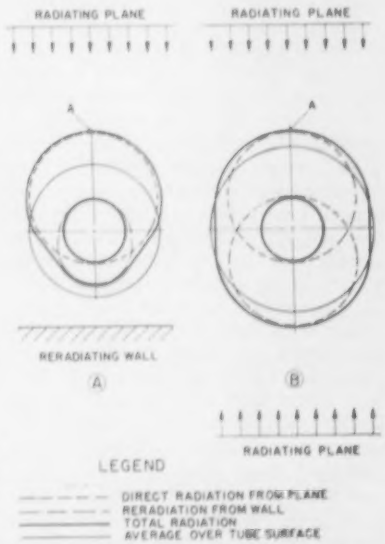
Where:

- Q = heat to be absorbed by radiation, B.t.u. per hour.
- A = outer surface of the coil as exposed to radiation, sq. ft.
- q = heat input rate B.t.u. per hour per sq. ft. taken as an average of all values existing in different areas of the outer surface along and around the tubes in the coil.

Thus, if with a given heat duty a maximum value is set for q, any coil proposed must have at least the outer surface A resulting from the above equation, regardless of tube size and coil disposition in the setting.

Many factors . . . The effects of the location of heat-absorbing surfaces with respect to radiant heat sources, of cold fraction in the heater, and of shape factors applicable to various furnace designs have been subjects of study by several authors, especially by H. C. Hottel and his associates.[1]

In a series of articles,[2] L. A. Mekler and R. S. Fairall have substantially contributed to this work, when among other items they outlined a simple method to find graphically the distribution of radiant heat flux around tubes in single or double rows subjected to direct and indirect radiation. Since it seems practical to refer to this latter



FLUX DISTRIBUTION diagrams for radiant heat input in fired heaters. Fig. 1.

REFINING

source in some of the following, the reader might do well to digest some of its contents.

Relative flux density . . . The flux-distribution diagrams such as are represented here from above sources[2] in Fig. 1 (also reviewed in Reference 4) furnish "relative" flux intensities around a tube as fractions of a maximum value called "one," which prevails in a cross-section of the tube at the point closest to the imaginary plane emitting radiation. These relative values take into account the effects of direct and/or reradiation and the degree of shading from adjoining tubes if the tube pitch is varied.

To make such flux diagrams suitable for use regardless of actual tube diameter and tube spacing, they are based on what could be called "relative tube spacings" which are dimensionless numbers denoting tube pitch as a multiple of the outer tube diameter over that diameter, nD/D. A preferred tube pitch is the double outer diameter, which results in a relative tube spacing n = 2.

Thus, for one condition of tube spacing and radiation as encountered in practice, one may set a **"maximum** flux density" of say 15,000 B.t.u. per sq. ft. per hour which obtains at the locations where the relative flux density value is "one" in the diagram. To determine actual flux density at other locations around the tube, one merely has to multiply this maximum flux value with the fraction representing the relative intensity at the location considered.

The "Disparity Factor"

For a given mode of radiation and relative tube spacing, take the arithmetic mean of all relative flux density values around a tube. A fractional value is obtained which is valid for said conditions regardless of the actual tube size and tube spacing. This fraction represents the relative mean or average flux density for these conditions. If again a practical value of say 10,000 B.t.u. per sq. ft. per hour is set as circumferential **average** flux density for a coil, it is evident from the foregoing that the corresponding **maximum** flux density may be calculated by dividing 10,000 by the relative mean flux value.

Although the mean fractional values related to various relative tube spacings and modes of radiation appear very significant, as will be shown later, they have never been given a name. These fractions define the lack of uniformity or parity of flux, or the **degree of disparity** of flux, around a tube. They permit to correlate the average flux value to the maximum flux value which is applicable to a given condition. Since this writer does not know of any better nomenclature set forward by others, he proposes the term "disparity factor" for these fractions, which term will be used henceforth in this article. Let us assign the symbol f_d to this term.

Tube flux density . . . The disparity factor deals only with flux-density relations around the tubes. It should not be confounded with effectiveness factors of tube banks as discussed in the mentioned source[2] and in other articles.[3,4] Circumferential effectiveness of banks is derived from the disparity factor by multiplying the latter with π/n, where n is the relative tube spacing.

From this, together with the emissivity of furnace areas and with the effectiveness factor accounting for the cold fraction,[3] the total effectiveness[4] of a furnace can be calculated. This in turn permits the evaluation of the radiant efficiency or "radiant extraction" in a furnace, which will be dealt with later.

What Disparity Factor Means

To give an example for the practical meaning of the disparity factor let us go back to the cited source[2] to compare conditions as they correspond to two types that are in actual use.

Example: In both furnaces a tube bank receives direct radiation from both sides. The tube spacing is 2.5 diameters in both cases (n = 2.5). In one heater the tubes are arranged in one row only, in the other in two staggered rows with center lines two diameters apart. Then, for the first case the disparity factor may be read from Table 1, Column 2, to read $f_{d1} = 0.870$. For the other case we refer to Table 2, Column 2, to read $f_{d2} = 0.614$. (See Tables 1 and 2 in Reference 2).

If we specify the mean flux density to be $(Q/A)_{av.} = 10{,}000$ B.t.u. per sq. ft. per hour, in either case, then the maximum flux density becomes:

$$\text{In first case } (Q/A)_{m1} = \frac{10{,}000}{0.87}$$

= 11,500 B.t.u. per sq. ft. per hour.

$$\text{In second case } (Q/A)_{m2} = \frac{10{,}000}{0.614}$$

= 16,300 B.t.u. per sq. ft. per hour.

The tube-wall thickness is computed with a stress allowable at the maximum tube temperature. The latter is derived from the maximum flux-density value. If the allowable tube temperature were derived from 11,500 B.t.u. per sq. ft. per hour the second heater, having 16,300 B.t.u. per sq. ft. per hour maximum flux density might locally overheat the tube wall.

On the other hand, if the maximum tube temperature were derived from 16,300 B.t.u. per sq. ft. per hour, a mean flux density of 16,300 × 0.87 = 14,160 B.t.u. per sq. ft. per hour may be used for designing the coil in the first type of heater, **resulting in a substantially smaller coil surface** than needed for heater case 2.

Such a comparison shows clearly that a coil with a higher disparity factor will allow for a higher average input rate than one with a lower one. One average flux-density value may be suitable and safe for one type heater, but risky for another type.

And vice versa, an average rate suitable for one style may be too low for another style to get the full benefit of its inherent design characteristics. It demonstrates also the doubtful value of the average absorption rate as part of the specifications for process heaters.

Uneven Distribution

Up to now in our discussion of flux diagrams we have only considered the difference in flux density around a tube in one cross-section. However, radiant rates are liable to differ considerably along the tubes in a furnace, mainly because radiant heat sources are never quite evenly distributed along the run of the coil. In many instances, as in thermal cracking, it is even desirable and necessary to apply different heat-input rates along different portions of the coil in order to control the coil gradient, the "heating curve." A suitable heating curve will set the beginning of a reaction at one particular place in the coil, allow for a minimum residence time as required for the reaction to proceed, for soaking, etc.

Effect on disparity factor . . . In short, differences in radiant rates along a coil are inevitable. It will be shown later that these differences are not a shortcoming at all; in most cases they are quite desirable. How will such differences affect the disparity factor? They will not—i.e., as long as the **mode of radiation and tube spacing are the same** over the length of the coil considered, the disparity factor remains

THE AUTHOR

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constant. However, our factor is due to change if different portions of a coil are subjected to **different modes of radiation.**

This might well happen in a coil having a portion of wall tubes in series with a portion of shock tubes, or in series with a portion arranged in double rows of tubes, etc. If one disregards such a change of the disparity factor one might well consider a "maximum average absorption rate," as one averaging the maximum flux density existing in the various cross-sections over the whole length of the coil.

Customary Limitations

There are, at present, three ways in which many furnace users like to specify the limitations on radiant heat density which they consider practical or safe.

1. Radiant absorption rate is limited to 10,000 B.t.u. per hour per sq. ft. taken as an **average** over the outside surface along and around the tubes, applicable to any heater without any distinction of the type of service it is to perform.

2. An upper limiting value is set for the **maximum** absorption rate taken over any unit area of the coil, also without consideration of the type of service contemplated.

3. In recognition of the considerable influence which composition and condition (phase, pressure) of the charge have upon its sensitivity to overheating, film cracking, etc., a whole set of different average and/or maximum average rates on any unit length are established to be applicable to the more common services of heaters in oil refineries.

Keeping Costs Down

While these well-meant limitations will in some instances bring about the desired result, namely a smoothly operating furnace, they seem just as ofen to hinder the designer in his task. This should be to utilize his materials of construction in full, thereby keeping the cost down to the necessary. It is clearly in any user's interest not to buy more heating surface than is needed for the duty involved, as long as the service life of the heating coil will meet with normal requirements.

Before we consider the merits of the above limitations we might well ask ourselves a simple question: **"What are we afraid of when we worry about putting too much heat into a furnace coil?**

1. Local overheating . . . Essentially there are two dangers which we want to avoid. We want to keep the tube wall from getting hotter in any area than the maximum tube-design temperature which we have calculated. Our wall thickness has been based on a working stress permissible at this temperature for the tube material selected. Thus, any wall area much hotter than expected may yield under the operating pressure. The tube may deform, bulge out, and finally rupture.

2. Decomposition . . . The other danger is that, where we want only to heat a fraction (merely a physical change), we induce unwanted decomposition of the c h a r g e (a chemical change). This second danger is often closely related to the first one. The more or less viscous fluid film adjacent the inner tube wall will crack if the conditions of initial decomposition occur.

Vicious circle . . . Thus, a hot spot in a tube creates a vicious circle: film cracking will deposit coke at the tube wall, adding a relatively high conductive resistance to the far lower one of the wall itself. The bulk fluid temperature near the hot spot considered will tend to remain unchanged, and the rate of radiant heat flow (at a certain firing rate) is fixed. But an increase in the over-all resistance, ΣR, to heat flow will call for a rise in the temperature potential Δt to overcome it, according to:

$$\Delta t = q \times \Sigma R$$

Thus, the outer tube wall will heat up still further. Unless the condition is detected in time to allow for remedy, eventual tube failure appears inevitable.

Tube Temperature Dominant Factor

Let us assume at this stage that the relative disposition of coil and burner flames has been designed so carefully[3] that local overheating in any portion of the coil will be prevented. What would then be a **reasonable heat input rate?**

To answer this question we might picture to ourselves in a simplified way the mechanism of heat interchange between flames and a fluid inside a coil, as if it consisted of two consecutive stages.

Radiant heat received by the tube will equal heat given off by the tube to the fluid inside by conduction and convection ($Q_r = Q_{cc}$).

(A)—Radiant heat transfer following Stefan-Boltzmann's law:

$$Q_r/A = 0.173\,F[(T_1/100)^4 - (T_2/100)^4]$$

Where:

T_1 = equilibrium temperature °R. at which the fire gases and the refractory walls radiate to the coil.

T_2 = outer tube-wall temperature °R. taken as a mean value over the coil surface receiving radiation.

Q_r = total r a d i a n t heat absorbed, B.t.u. per hour.

A = total coil surface exposed to radiation, sq. ft.

F = emissivity of the coil surface.

(B)—Heat transfer by conduction and convection following Newton's law of driving forces and resistances:

$$\frac{Q_{cc}}{A} = \frac{t_2 - t_3}{\Sigma R}$$

Where:

Q_{cc} = heat transmitted from t u b e wall to fluid, B.t.u. per hour.

ΣR = sum of all resistances to heat flow between outer coil surface and bulk fluid inside coil, $\frac{\text{Sq. ft.} \times \text{hr.} \times {}^\circ\text{F.}}{\text{B.t.u.}}$

t_2 = temperature of outer tube wall, °F.

t_3 = temperature of bulk fluid, °F.

Although self-evident, the above should be restated in simple words: **the fluid in the tubes does not receive radiant heat at all—only the outer tube surface does.** And the hotter the tube surface, the more heat will be transmitted to the fluid. It becomes clear that our interest lies in having the tube wall as hot as its material will stand under the stress resulting from the inside pressure, the usual safety factors considered.

It doesn't do us any good to design any portion of a coil on the basis of a calculated tube-wall temperature, unless we really run that coil section at that temperature. If we design for 100,000 hours tube life at the calculated maximum tube-wall temperature and we accept the substantial extra cost of a heat resisting alloy and of a tube-wall thickness affording this tube life, the extra expense is wasted if we operate that coil portion substantially b e l o w the rated temperature.

Going one step further we may reflect as follows: **Not radiant rate, but tube temperature should logically be the dominant factor in radiant coil design.** Radiant rate may be regarded a dependent function of tube temperature and **should be permitted to vary over a wide range of values**—as it actually does in any coil due to the varying temperature potential between tube wall and fluid prevailing along the fluid's path.

The economically ideal coil would have the maximum allowable wall temperature t_2 over its whole length. As the temperature potential $t_2 - t_3$ decreases from inlet to outlet of such an ideal coil, the heat input rate will decrease in direct proportion. This decrease is not linear because the sum

of the resistance, ΣR, decreases also with a rising bulk fluid temperature.

Reasonable Input Rate

Now we are in a position to answer the question posed before as to what is a reasonable radiant input rate. Any input rate appears reasonable which will produce as high an outer tube-wall temperature as can be sustained in continuous operation. However, in talking about tube-wall temperature we must remember again that the flux density in each cross-section varies around the tube circumference as expressed in the disparity factor applying to that coil portion.

If we neglect the relatively small variation of conductive and convective resistances over the circumference of any cross-section, it may be concluded that the tube-wall temperature follows a similar pattern as the flux density around a tube.

The hottest zone around a tube prevails along that generatrix at its surface which is closest to the imaginary radiation emitting plane. (If direct radiation is applied from two opposite sides, two equally hot zones will exist along diametrically opposite generatrices on the tube surface.)

The temperature t_2 which we wish to allow for this hottest zone will be the design value which in conjunction with bulk fluid temperature t_3 and with the sum of the heat flow resistances that vary along the coil with the heating curve, will furnish the maximum heat input rate applicable at each coil section.

Radiant Heat Extraction

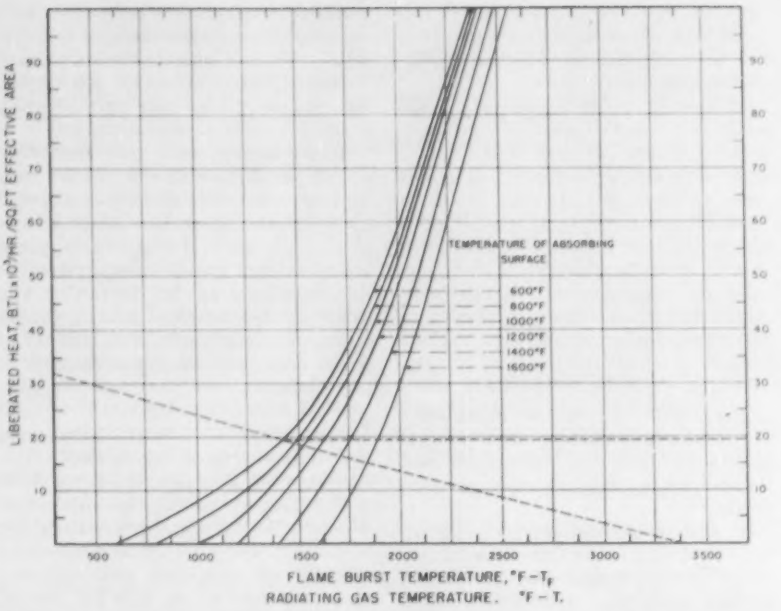
But something has been neglected in the above considerations. From the hottest zone in the tube wall some heat will be conducted by the tube wall circumferentially toward its cooler zones. Heat will thus be dissipated from the zone of maximum flux density. The actual peak temperature in this zone is bound to be lower than the one calculated from the radially acting flow resistances only.

When it was said above, "Any input rate appears reasonable, which . . .," this must be taken with the usual grain of salt. If we refer again to the source mentioned,[2] there is a chart which correlates the Stefan-Boltzmann law in the range of values applicable to heater design. This chart is reproduced here as Fig. 2.

With the flame burst temperature fixed in one particular furnace we can increase our fuel rate and thereby raise the equilibrium temperature T_1 in the furnace box.

High or Low Radiant Extraction

A straight line connecting the point on the abscissa for the flame burst temperature and the intercept of the ordinate for the absorption rate with the curve for the tube-wall temperature will represent the operating condition.



STEFAN-BOLTZMANN EQUATION may be solved in the range of values applicable to heater design b ythis chart. Fig. 2.

If the box temperature rises, the intercept moves to the right, the operating line gets steeper. The steeper this line, the lower becomes the **ratio of the heat absorbed to the heat to be liberated—the radiant extraction.**

If the radiant extraction is low, it will be necessary to add more convection load to keep the over-all heater efficiency within economical limits, which are dictated by the unit cost of the fuel used. In other words, the limit of how high a radiant rate we may choose will depend upon how low a radiant extraction we can accept. This in turn will depend on the acceptable minimum efficiency, and on how high (if any) a convection duty is specified.

There is another economical fact which tends to limit the radiant heat input rate. A higher equilibrium temperature means a hotter furnace. It will need higher grade, more expensive refractory walls. Maintenance cost for the heater might unduly increase.

Let us consider radiant extraction again as represented in Fig. 2 of this article. Heat-input rates are referred to the "effective" area. The effective area A_E equals the "projected" area A_P times the over-all effectiveness E of the bank.[3,4] For one tube row the projected area is derived from the circumferential area A_C by multiplying with n/π, where n is the relative tube spacing. Then:

$$A_E = A_C \frac{nE}{\pi} \text{ and } \frac{Q}{A_E} = \frac{Q}{A_C} \times \frac{\pi}{nE}$$

If we wish to use Fig. 2 to determine the radiant extraction in a heater, we have to convert the actual radiant surface, which we have calculated, to the corresponding effective surface. Before we can do that, we must calculate the over-all effectiveness E[4] from the effectiveness of the cold fraction,[3] and from the emissivity of the "cold" surface. Depending on the disposition of the heating surface inside the envelope this procedure might have to be carried out for each portion of a coil separately[4] to account for different cold fraction effectiveness and emissivities applying to each coil portion.

"Semifacts"

Having duly considered our problems from various angles, we are now better qualified to reflect on the prevailing "semifacts" that now govern heater design. (Refer back to heading "Customary Limitations.")

The limitation (1) above is so well established that furnace builders are inclined to apply it even when no limiting rate value appears in a furnace specification. Nonetheless, it is the one most open to doubt. Its shortcomings are twofold.

A. It does not recognize that some fluids will bear much higher heat input rates than others without suffering any damage. This writer has recently seen it applied to a case where a gas stream consisting essentially of methane and nitrogen had to be heated

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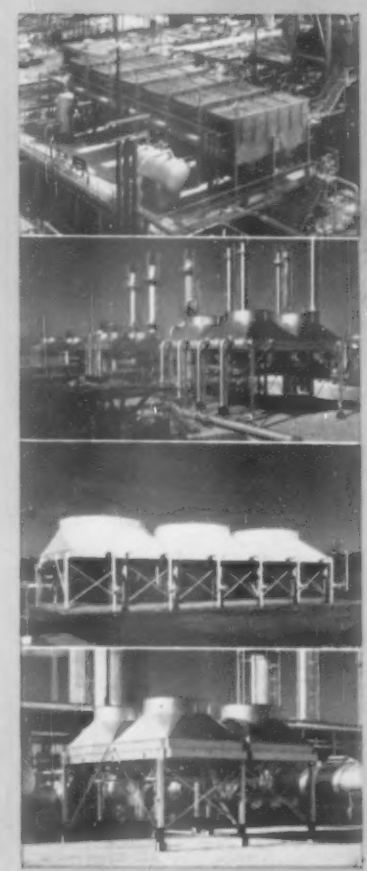
In Equipment For

Cooling with Air

More than 600 HUDSON Solo-aire and Combin-aire Units are giving complete satisfaction both in mechanical operation and in meeting cooling performance specifications in . . .



OIL REFINERIES

Solo-aire Units, installed in space formerly occupied by water box submerged coolers, are used for condensing and oil cooling, eliminating water circulation of 4200 gallons per minute. Previous high maintenance costs due to water scaling and corrosion are also eliminated.

GAS PROCESSING PLANTS

Solo-aire Units as pictured at left, and Combin-aire Units, are minimizing water consumption, lowering water treatment costs, and lowering over-all maintenance expense in scores of Gas Processing Plants in the United States, Europe, Pakistan and South America.

COMPRESSOR STATIONS

Solo-aire Units are installed in many of the larger main line Compressor Stations in the United States for cooling gas, jacket water, and lube oil. HUDSON auto-variable pitch fans allowing accurate, automatic control of cooler outlet temperature are used in many of these installations.

CHEMICAL PLANTS

Vapor at 550°F. is condensed and condensate subcooled in Solo-aire pictured at left. In services for cooling of very high temperature fluids, and cooling of fluids with which water contamination must be avoided, Solo-aires are particularly adapted.

Experience The first HUDSON exchangers using air as the cooling medium were installed over 20 years ago for condensing exhaust steam. Thru constant research, improvement and innovation in design and in manufacturing techniques, and in development of units for special applications, HUDSON reached and has retained its position of leadership in "Cooling with Air."

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LARGE POWER SAVINGS
and Accurate, Automatic Temperature Control
with HUDSON AUTO-VARIABLE PITCH FANS

WHY do Hudson Auto-variable pitch fans on Hudson Solo-aire and Combin-aire units not only *give accurate temperature control* of cooled streams, but — *save up to 85% of fan horsepower* compared with conventional fixed pitch fans?

BECAUSE fixed pitch fans are usually selected to move the air required under conditions of summer air temperature and maximum heat load, and needlessly move such maximum quantity even under conditions of winter air temperatures and lower-than-design heat loads. With Hudson Auto-variable pitch fans the blade pitch is automatically controlled by outlet cooled fluid temperature so that only the quantity of air required to maintain this temperature is moved. This quantity in winter may be only 30% of that required in summer, resulting in fan horsepower saving of 85% attributable to Auto-variable pitch fans as compared with conventional fixed pitch fans.

OVER 200 AUTO-VARIABLE PITCH FANS are providing accurate, trouble-free temperature control in Hudson Solo-aire and Combin-aire units. Minute changes in cooled fluid outlet temperature immediately and automatically changes pitch of fan blades, increasing or decreasing flow. Control is effective despite changes in heat load or hot fluid inlet temperature; and over ambient air temperature range of more than 150° F.

Consult Hudson for more detailed information on the application of Auto-variable pitch fans to present or future installations.

HUDSON AUTO-VARIABLE PITCH FANS

- **Accurately control temperature.**
- **Effect major savings in power.**
- **Reduce cost of control equipment.**
- **Eliminate by-pass piping.**
- **Prevent freezing even in extremely cold weather.**
- **Operate with standard pneumatic instruments.**
- **Have all moving parts of control mechanism completely enclosed and weather-proofed.**

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to about 500° F. Obviously no harm can be done to such a mixture if far higher heat rates are used.

B. It does not recognize that a mean rate value for one set of conditions does not equal the mean rate for another set of conditions. It neglects and ignores our disparity factor. Thus it penalizes the case with a high disparity factor for the shortcomings of another with a low factor. Ironically, it penalizes its originator because he has to pay for excess coil surface.

Limitation (2) makes somewhat more sense, but it has the same shortcoming as under (A) above and it restricts the designer's freedom to use a higher input rate where the fluid is comparatively cool, the temperature difference high, and a higher absorption should be quite acceptable.

Limitation (3) is free from the shortcomings under (A) above, but it fails still on the grounds stated under (B).

Summary

Evidently the usual limitations of the heat absorption rates fail to provide the solution for which they were intended, e.g., to protect the fluid in process or the heating coil from overheating. They seem to be cliches grown out of half-digested facts. As said earlier, they often present an obstacle to the furnace designer who wishes to keep cost down to his client's interest.

- This view seems to find support in the fact that some large refining firms have more recently abandoned the practice of prescribing input rates. Instead, they rightfully limit the tube-wall temperature.
- In this writer's opinion, both parties involved, furnace user and supplier, would fare best if stringent rules that cannot be justified by physical facts, were omitted.
- From his knowledge of the stock he wishes to run, the refiner is in a position to prescribe a limit for the temperature which a fluid film inside the tube may be permitted to reach. He may set a maximum tube temperature that he deems safe for the stock, applying to the tube surface.

The refiner does well (this has been standard practice with some firms) to prescribe the type of tube material he wishes to be used for each temperature range of the metal or of the fluid in the coil. From there on his interests would be served best if he would permit the supplier to propose whatever he has to offer, provided the latter is willing to guarantee the required performance.

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2. L. A. Mekler and R. S. Fairall, "Evaluation of Radiant Heat Absorption Rates in Tubular Heaters," Petroleum Refiner, Vol. 31, No. 6, 11-12.
3. L. A. Mekler, "Heaters for Petroleum Refining," National Petroleum News, July 27, 1938.
4. L. A. Mekler, "Process Design of Tubular Heaters," The Oil and Gas Journal, Oct. 3, 1955.

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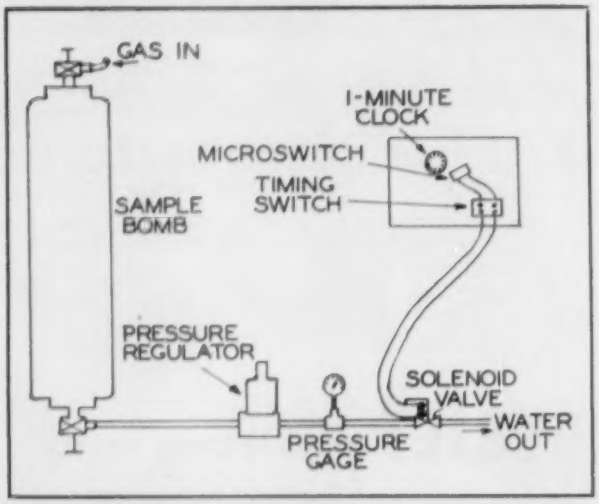
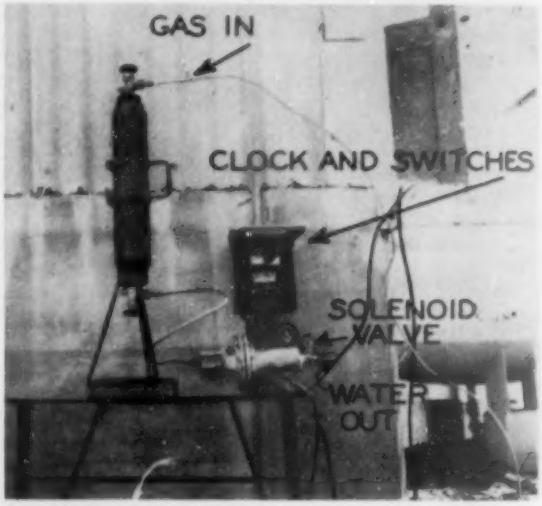


SAMPLING SYSTEM for obtaining composite sample of ethane sales gas. Fig. 1.



SAMPLING SYSTEM sketched in Fig. 1. Note the simplicity of construction.

How La Gloria increased efficiency by . . .

Improving cycling-plant operations

by Larry Resen
District Editor

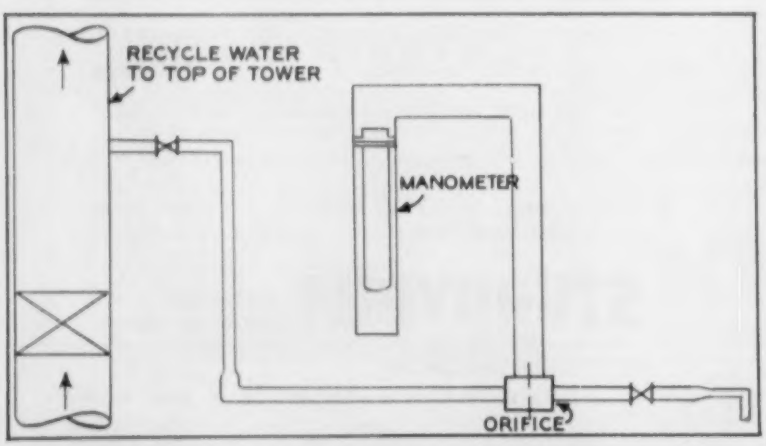
OPERATIONS at La Gloria Oil & Gas Co.'s Falfurrias, Tex., cycling plant are constantly improved by on-the-job study of methods and procedures.

Some of the recent modifications include: (1) an automatic sampler for a sales line; (2) a continuous blowdown system on the cooling tower; (3) utilization of residue-gas pressure in an expanding gas turbine; and (4) the application of corrosion-resistant coatings.

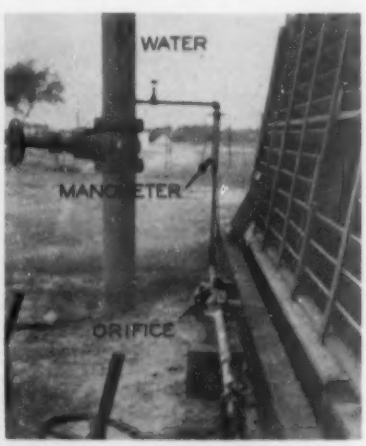
Automatic sampler . . . This was developed for use on an ethane-gas sales line. The sales contract calls for a composite sample of the sales gas each week. A small sample of gas is collected every 60 seconds during the week.

The equipment used in the sample system consists of: (1) a sample bomb, supported in a vertical position on a ring stand; (2) a pressure regulator; (3) a pressure gage; (4) a solenoid-operated valve; (5) a microswitch; and (6) an electric clock. Tubing is used to make the necessary connections. The gas-sample line is connected to the top of the bomb, and the bottom of the bomb is connected to the high-pressure side of the regulator (Fig. 1). The low-pressure side of the regulator is connected to the solenoid valve, and the pressure gage is placed between the two. A bleed line runs from the solenoid valve to the ground.

In operation, the bomb is first filled with water and the gas is turned into



TAKEOFF SYSTEM for continuous blowdown on plant cooling tower. Fig. 2.



BLOWDOWN SYSTEM sketched in Fig. 2.

the system. The pressure regulator is adjusted to hold about 40 psi. on the solenoid valve. This is set to operate once every minute by means of the controlling mechanism, including the microswitch and electric clock. The clock makes one revolution per minute and closes the microswitch every 60 seconds to energize timing switch. This permits the solenoid valve to open once, giving the desired displacement of 0.4 cc. of water each minute.

The pressure of the solenoid valve governs the amount of water displaced each cycle. The present setup provides for filling the bomb with gas each 7 days.

Blowdown . . . A simple takeoff system is provided for a continuous blowdown on the cooling tower at the plant (Fig. 2).

The system consists of a length of 2-in. pipe to serve as a meter run, an orifice plate plus appropriate taps, and a manometer and required tubing. The blowdown water is tapped from the riser which carries recycle water to the top of the tower. This water passes through a 1-in. line into the meter run, with a small valve inserted on the 1-in. line to control flow.

Flow is indicated by the differential reading on the manometer. With a constant head on the system, it is a simple matter to compute the amount of blowdown.

Under normal conditions, the amount of evaporation is usually fairly constant, and it is possible to operate for a long while without adjusting the valve.

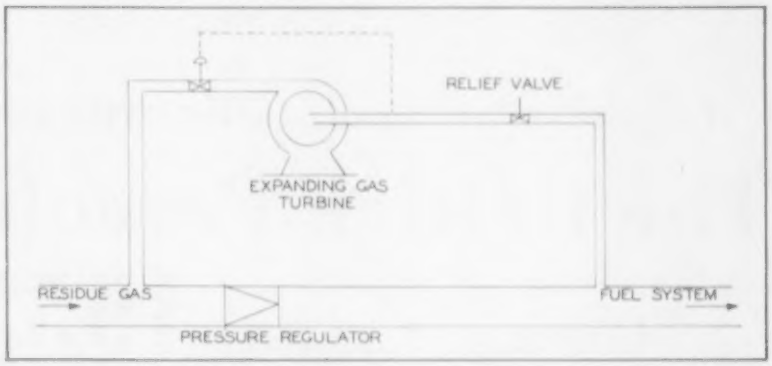
When changing blowdown, it is a simple matter to compute the differential reading necessary to achieve the desired flow rate, and then adjust the blowdown valve the proper amount to effect the proper differential.

Turbine . . . At La Gloria, about 15 M.M.c.f.d. of residue gas is used in the fuel system. This has to be reduced from 300 psi. to about 45-50 psi. for use in the fuel-gas system.

In order to take advantage of the energy dissipated in this pressure drop, a Moore steam turbine was modified into an expanding-gas turbine. This was done by the addition of carbon rings and by changing the vanes slightly on the turbine rings so they would operate on expanding gas. This requires about 3 M.M.c.f.d. of the fuel gas. More of these units are planned to utilize more of this energy.

The piping for the turbine was arranged to bypass a pressure regulator normally used to drop the pressure on the fuel-gas line (Fig. 3). A motor valve operated by the exhaust of the turbine is used to prevent the pressure on the turbine case from exceeding 55 psi. Further downstream is a large pop valve which functions in case the motor valve fails and the exhaust pressure exceeds 65 psi., the safe working pressure limit on the turbine exhaust and case.

The 100-hp. turbine is used to drive a pump which maintains pressure on the fire system, the water feed to the lime softener, and the gas-sprinkling lines. Of course, auxiliary pumps are also available for these services.



EXPANDING-GAS TURBINE recovers energy ordinarily lost in reducing residue-gas pressure. Fig. 3.

HOMER C. GIVENS, La Gloria plant manager, explains the use of the expanding-gas turbine.

Corrosion . . . A constant problem in the region is the corrosion of exposed equipment. To combat this, La Gloria is using an Insul-mastic coating. This protective coating is formulated with a high proportion of gilsonite asphalt plus various mineral fillers, plasticizers, and some volatiles. The result is a material which bonds securely to various types of building materials.

The material is applied by spraying onto a surface which has been previously sandblasted and primecoated. The Insul-mastic surface is finally painted to improve plant appearance. The coating has been used more than 3 years on vessels, tanks, valves, and pipelines and has performed well.

All uncoated vessels are being coated as they require repainting. It's estimated that the use of the asphalt-type coating costs about one-third more than conventional painting. This is offset, however, by reduced painting frequency. Previously, it was necessary to repaint all vessels about once a year. Now they are painted every 18-24 months, and it is not necessary to sandblast the surface as before. This painting is chiefly for appearance since the asphalt coating has remained unaffected since its original application.

The coating is used on cold lines which normally drip. Condensation and dripping have been eliminated.

Acknowledgments

The cooperation of Homer C. Givens, plant superintendent, and others in the management of La Gloria Oil & Gas Co. is gratefully acknowledged.

All phases of operations expanded by

The British Petroleum Company Limited *in* 1955

British Petroleum occupies an important role in meeting the free world's expanding demand for petroleum, which last year continued the post-war trend which has resulted in a doubling of world consumption of oil products in the last ten years. This strong demand lies in the growth of industrial activity and improving standards of living and, in the Eastern Hemisphere, in the more limited capacity for increasing output of other major sources of energy, especially coal. There is every indication that this post-war rate of expansion will be maintained until nuclear power becomes available to supplement world energy resources on a substantial scale. Thus in the next ten years the world petroleum industry may well be again called upon to double its present output. The rate of expansion can be expected, as now, to be greater in the Eastern Hemisphere, where BP has the bulk of its operations. Also, the oil-producing territories of the Middle East, in which BP has a substantial position, are expected to contribute an increasingly large proportion of the world's requirements.

FINANCIAL HIGHLIGHTS

	1955	1954
Gross Consolidated Profit	£139,817,943	£118,228,792
Depreciation	£ 22,143,401	£ 30,406,091
Overseas and U.K. Taxes	£ 71,389,475*	£ 69,392,188
Net Profit to BP	£ 46,189,539	£ 17,043,404
Dividends	£ 15,719,085†	£ 9,254,999

* Unilateral relief for overseas tax for 1955 only

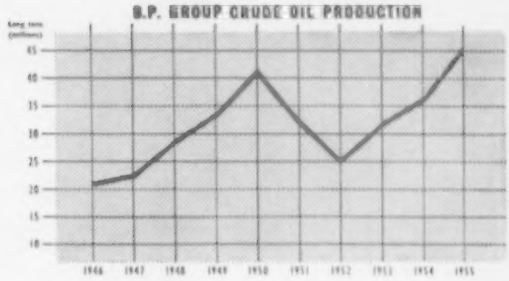
† Including recommended final dividend

THE BRITISH PETROLEUM COMPANY

BRITANNIC HOUSE • FINSBURY CIRCUS • LONDON • E. C. 2

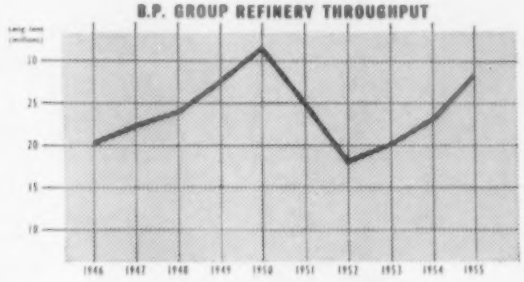
Crude oil production by BP last year rose 25 per cent to a new high of 920,000 barrels daily, with the increase due mainly to greater production in Iran and Kuwait. Total daily offtake from Kuwait, Iraq, Iran and Qatar was 910,000 barrels, compared with 730,000 barrels in 1954. The company's liftings last year from Iran, in which BP has a 40 per cent interest, was at the rate of 110,000 barrels daily.

B.P. GROUP CRUDE OIL PRODUCTION



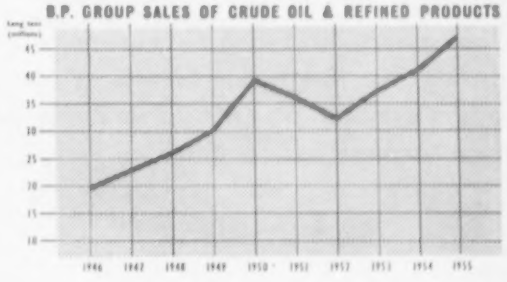
Refinery throughput at BP's 14 refineries during 1955 was 590,000 barrels daily, up 110,000 barrels over 1954. The increase was largely due to 1955 being the first complete operating year of Aden refinery, and the first operating year of Kwinana refinery in Western Australia. Also, BP's share of processing at Abadan refinery in Iran totaled 52,000 barrels daily during its first complete year of operation under the Consortium agreement of October, 1954.

B.P. GROUP REFINERY THROUGHPUT



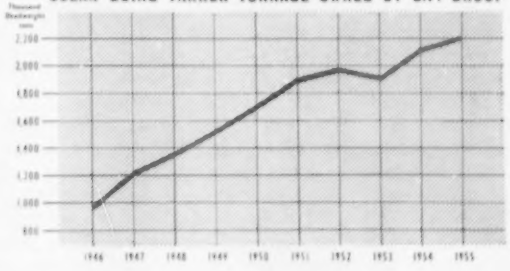
Sales of crude oil and refined products in 1955 reached a record high of 960,000 barrels per day, an increase of more than 120,000 barrels over 1954. Approximately $55,000,000 was spent last year to strengthen and expand the company's world-wide marketing outlets. Noteworthy gains were made in Europe in 1955, where BP marketing associates increased their sales by more than 20 per cent.

B.P. GROUP SALES OF CRUDE OIL & REFINED PRODUCTS



Forty-one tankers totaling 1,225,500 deadweight tons are on order for BP, the biggest ship building program in the company's history. The cost of this program, which includes ships ranging from 42,000 tons to 14,000 tons, will exceed $224,000,000. The company's present tanker fleet consists of 144 ships totaling 2,018,000 deadweight tons. In addition, some 2,500,000 deadweight tons of tanker shipping is on charter.

OCEAN GOING TANKER TONNAGE OWNED BY B.P. GROUP



LIMITED

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THIS SHOT-HOLE RIG drills wells rapidly, using air as the circulating medium, in the shallow water-flood area of Nowata County, Oklahoma. Fig. 1.

Air Drilling Shallow Water-Flood Wells

A small rotary rig circulating air has met the need for 1-day drilling and completion of 400 to 600-ft. water-flood wells. Costs are no more than for cable-tool drilling and operations take only a third the time.

by L. L. Brundred

ROTARY drilling with compressed air has progressed from the haphazard experimental stage to a practical engineering achievement. When effort was made to adapt it to large-scale development of a shallow water flood, some of the equipment and a number of practices used by the "slim-hole" driller had to be changed before this type of drilling could be considered an economic success. Here are results obtained in this development drilling:

- Speed is an inherent factor in air drilling, and yet the formations cut can be quickly identified. There is now no excuse for "drilling into the sand" without knowing it.
- Coring has become routine and recovery now approaches 100 per cent. Shale can be cut with a diamond bit almost as fast as sand. Core analyses indicate that oil and water saturations are probably more representative of true reservoir conditions than a core taken with oil, water, or water-base mud.
- The handling of intermediate waters offers no problem provided adequate compressor capacity is available.
- Proper cleaning out after the shot is one of the outstanding results of the use of an air rotary.
- Air drilling is so fast that only long-range planning, with every part of the operation "scheduled," similar to a production line in a factory, can meet the demands of large-scale development in a shallow water flood.

Author is with Climax-Brundred Waterflood Division, Climax Molybdenum Co., Tulsa. This is an abridged version of a paper presented to the spring meeting of the Mid-Continent District, A.P.I. Division of Production, Wichita, under the original title "Rotary Drilling with Air in Shallow Water-Flood Development."

Experimentation . . . Recognizing the possibility of rotary drilling in the shallow Bartlesville sand fields of Nowata County, Oklahoma, Overby Drilling Co. moved a drilling rig (Fig. 1) into the area in February 1955 on an experimental basis. The rig had been used in air-drilling operations in Callahan County, Texas. It was a Mayhew 1000 equipped with both mud pump and compressor, integrally mounted. The compressor was a single-stage unit with a capacity of 315 cu. ft. per minute. The rig was first used to open up previously abandoned wells at depths of approximately 650 ft. in order that they could be cleaned out and properly replugged with cement.

The next step in the experimental program was to move the rig to shallower territory, 400 to 450 ft. deep, to determine if drilling operations could be conducted on a cost basis comparable with cable tools. It was known that surface and intermediate waters were present in that area and the problem posed by such waters had to be met if the operation was to be successful.

Surface water was eliminated by setting surface casing. It became apparent almost immediately that it was impossible to handle the intermediate water with the small single-stage compressor with which the rig was equipped. The operating pressure increased beyond the

DRILLING

SAMPLES ARE CAUGHT and placed in the numbered sample boxes where they can be examined rapidly. The pay sand is readily identified by visual inspection of the cuttings. Fig. 2.

capacity of the compressor and no progress could be made.

This led to the addition of a gasoline-driven 300-cu. ft. two-stage compressor, mounted on a trailer and hooked in parallel with the 315-cu. ft. unit. Although this added capacity solved some of the problems and speeded up drilling materially, results were still somewhat unsatisfactory. At about this time, the single-stage compressor on the rig was damaged and the maintenance cost of operating this unit became prohibitive for this type of work. Temporarily, this left only the 300-cu. ft. two-stage unit to do all the work; but as long as relatively small amounts of water were encountered, fair results were obtained.

New program . . . Up to this time the program called for the drilling of the wells to the top of the 400 ft. sand with the air rotary, which was then moved off and replaced with a typical small spudder for "tailing in," i.e., shooting, cleaning out, and cementing 2-in. cement-lined tubing in the well. Although results were considered fair, costs were still too high and this led to the conclusion that the air rotary could and should do all of the drilling, shooting, and cleaning out. It was also concluded that the time-consuming work of setting and cementing tubing should be left to a pulling machine. This has proved so successful that it is now standard practice in all completions.

During the summer months of 1955, a further examination of costs led to the belief that additional changes must be made if rotary drilling with air was to be competitive with cable-tool drilling. It should be borne in mind that, up to this time, some of the drillers were relatively inexperienced and knew very little about the formations encountered. The rapidity with which they adapted themselves to this particular area was, however, quite gratifying. It was equally true that management had to learn to evaluate the work being done by the rig. A series of conferences resulted in the following changes being made over a period of approximately 2 months:

1. Spudding in had been done with an 8¾-in. bit and from 8 to 40 ft. of 6¼-in. casing had been set as "drive pipe." Although the same size bit was retained, surface pipe was increased to 7-in. o.d.

2. Instead of one 5-in. o.d. by 20-ft. drill collar, two 5-in. by 20-ft. drill collars were used to provide the added weight necessary to increase the speed of drilling.

3. The 6-in., three-cone, "hard-formation" bits were eliminated and new 6¼-in., three-cone, "medium-formation" bits were substituted. This change increased the clearance between the drill collars and the drilled hole and permitted more rapid passage of larger chip cuttings from the bottom of the hole to the surface. This proved of the utmost importance in evaluating the formation being drilled. In this particular area, one new bit will usually drill three wells without rebuilding.

4. The 300-cu.-ft. two-stage gasoline-driven compressor was eliminated and a 600-cu.-ft. diesel-driven two-stage compressor was substituted. This permitted the driller to handle large quantities of water and yet keep the hole blown dry even when producing as much as 600 bbl. of water per day. Previously, when water exceeded a rate of approximately 200 bbl. per day, it had been necessary to switch from compressed air to mud. This materially slowed the drilling rate.

5. The 2⅜-in. drill pipe was eliminated and 3½-in. o.d. standard drill pipe in 20-ft. lengths was substituted. This reduced the operating pressure at the compressor from approximately 90 psi. to 60 psi.; raised the estimated pressure at the bit from 25 to 40 psi. The linear velocity of the cuttings was increased from approximately 3,300 to 4,100 ft. per minute, thereby decreasing the time of travel of the cuttings from bottom of the hole to the surface. A number of tests showed that cuttings reach the surface in a 400-ft. hole in 11 seconds, or with sufficient rapidity to detect immediately any change in formation encountered by the bit.

6. The number of men on each crew was reduced from three to two, operating on three 8-hour tours per day. While tearing down, moving, and rigging up on a new location, a tool pusher and one extra man were added to the crew for only a few hours.

7. A special 90° F. deflector, 6 in. in diameter, and fitted with a rubber gasket around the kelly was added to divert the cuttings horizontally for sampling. These are sifted through hardware cloth to obtain large chips for immediate analysis of the formations being drilled. With frequent sampling, a complete well "log" is obtained from the grass roots down. Fig. 2.

Shooting and cleaning out . . . When "tailing-in" operations with cable tools were discontinued in favor of doing this work with the rotary, and the task of running tubing and setting and cementing the packer was given to a pulling machine, completion costs began to decrease and completion speed increased. An extra move was thus eliminated.

Efficiency was further increased by the use of the company two-way radio system which permitted calling the shooter as soon as the Black sand in the bottom of the pay zone was encountered or, if this sand was absent, as soon as the bit picked up the shale underlying the sand body itself. This became a marker bed, easily distinguished by the chips. Under this schedule, the shooter, who had been alerted to expect the order for the shot to be called in over the radio from the rig, is soon on his way.

In the meantime, the drill pipe is pulled and racked; a steel-line measurement is taken on the bottom of the hole for accurate shot placement. With the small rotary it requires approximately 30 minutes to pull and lay down the drill pipe on a trailer, where it is ready to be picked up and rerun quickly.

Little time is required to place the

shot; and within 15 minutes after the shot is set off, drill pipe is again run in to clean out the hole using the same 6¼-in. bit used for drilling. Should the intermediate water fill up in the hole, as it often does, the bit is stopped about 200 ft. from the surface and the well is blown clear of water to that point. The remainder of the drill pipe is then run until cave is encountered, at which time the hole is again blown dry before cleaning out is started.

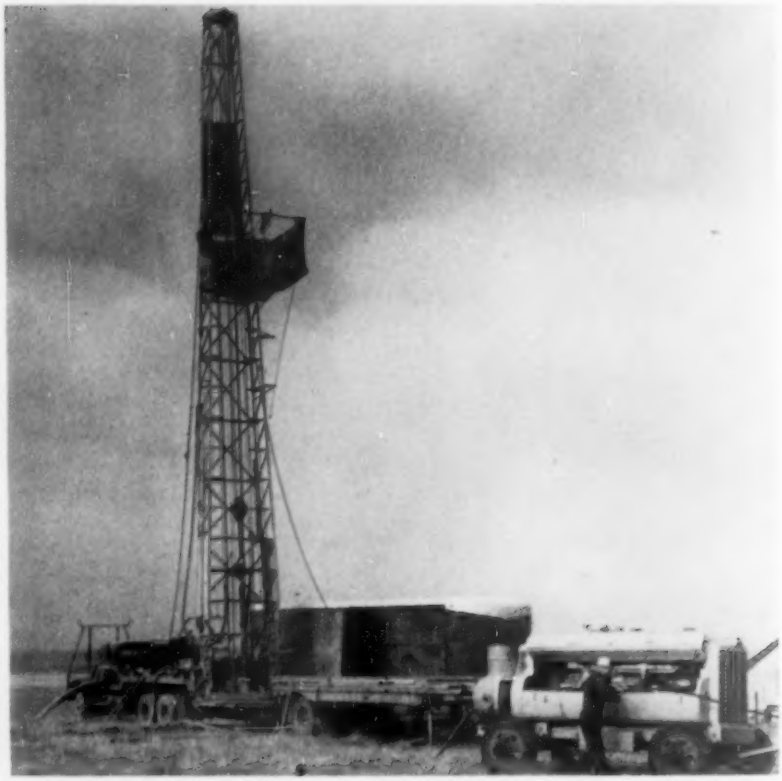
From here on the bit has but one function, viz., to break up the large chunks of cave, consisting principally of pieces of fractured sand. Very little upper-hole cave is encountered because of the rapidity with which it has been drilled. It should be noted here that the absence of water or mud in prolonged contact with the wall of the drilled hole seems to eliminate even normal cave, and therefore it is not a serious problem.

The drill pipe is worked up and down in the hole rapidly after bottom has been reached. Thus the entire air stream is directed against the sides of the shot hole and this seems to dislodge an occasional chunk of sand which is soon ground up and blown out.

After about 1½ hours' elapsed time used in cleaning and blasting the sides of the shot hole, the rig is shut down with the bit located near the top of the sand. The intermediate water is thus purposely allowed to run down into the shot hole for approximately ½ hour. This water has a tendency to cause additional cave in the shot hole. This is soon removed and the drill pipe is again worked up and down the hole rapidly until no further material is brought to the surface, and again the rig is shut down with the bit hanging near the top of the sand.

At this point in the time schedule, the mud pump on the rig is started up and a combination of air and water is used to clean the face of the sand as the drill pipe is lowered slowly to bottom. Occasionally this produces a small amount of cave; but after the first or second run, which takes but a few minutes, the well is considered completely clean. In fact, it is probably much cleaner than if the work had been done with cable tools. Then the drill pipe is pulled out and laid down. The rig is then torn down and moved to the next location and rigged up. This seldom requires more than 1 to 1½ hours.

Results . . . During the months of September, October, and November 1955, 26 wells were completed each month to over-all depths ranging from 395 to 465. This schedule was occasionally disrupted by the necessity of making minor repairs, changing bits, and other delays; but at other times was speeded up so that on the average it was possible to complete one well each working day during those 3 months.



THE LARGER SHOT-HOLE RIG is used on 700-800-ft. holes and uses the 600-cu.-ft. compressor shown in the foreground. Fig. 3.

The pulling-machine schedule permits the work to be done by a roustabout crew during daylight hours. Should the cement go by the packer, the tubing can be pulled before the cement takes its initial set, and can be quickly washed out before any damage to the sand face occurs.

Bigger rig . . . Several months ago, Overby Drilling Co. purchased a new Mayhew rig No. 2000, equipped with the usual mud pump, but no compressor was mounted on the rig. It carries a 58-ft. mast. This machine was initially used in coring at 650-ft. depths using 3½-in. drill pipe and two 5-in. o.d. by 20-ft. drill collars.

With the taller mast the drill pipe can be pulled in 40-ft. sections, thus saving a considerable amount of trip time. Coring has been very satisfactorily done with this machine and it is planned to use it continuously in developing a large block of acreage at this depth. Also, as in the case of the first machine, a 600-cu-ft. two-stage trailer-mounted compressor will be used.

Drilling done in the area where this machine was first put to work was considerably slower than in the 400-ft. area, largely because of more hard-lime sections. Large amounts of intermediate water were present and some tendency to cave was experienced. The addition of another drill collar may prove beneficial in speeding up drilling and, as the drillers gain more experience in this area, drilling time should be reduced.

Although a three-man crew is at present employed on this larger rig, it may be possible to cut to a two-man crew, thus further reducing costs.

A picture of the larger rig is shown in Fig. 3.

General observations . . . As a direct result of drilling more than 89,000 ft. of hole during 1955, without any loss of drill pipe or even one serious fishing job, using air as a drilling fluid, a few obseravtions are considered important:

1. **Where no water is encountered:** This is the most favorable condition and maximum speed is attained. No abnormal wear on bits, drill collars, and drill pipe has been observed; but proper precautions are invariably taken to prevent dust from getting into bearings, motors, and other equipment which might be damaged.

2. **Where small amounts of water are present:** This seems to offer the greatest

hazard and requires that the driller on tour be alert against sticking of drill pipe was subsequent risk of a twistoff. The bit then has a tendency to mud up and drillers have learned that drilling as little as 6 in. of formation producing a very small amount of water, perhaps 3 to 5 bbl. per day, has considerable element of risk. This situation can readily be corrected by cutting in the mud pump and quickly adding to the compressed air, 1, 2, or even 3 bbl. of clear water to clean up the hole. Thereafter the mud pump can usually be shut down and it is seldom necessary to add water again; unless, of course, a new water-bearing formation is picked up.

3. **Where excessive water is encountered:** It is not at all uncommon to run into intermediate water zones which produce from 100 to 500 bbl. per day. Such amounts can readily be handled with adequate compressor capacity and cause little delay in drilling. It has been found advisable, however, to have a slush pit available at each well drilled in the event that any water is uncovered as it would be inconvenient and costly to have to shut down to dig such a pit after water is encountered. A pit is good insurance against surface-damage claims.

4. **Compressor capacity:** The heart of the operation lies in having adequate compressor capacity of sufficiently high working pressure to take care of most eventualities. A 600-cu.-ft. two-stage compressor is adequate for drilling a 6¼-in. hole to a depth of 650 ft. Although there have been times when added capacity might have speeded up drilling or cleanout work to some extent, the added cost of operation of any greater-capacity machine would have so increased the cost of operation of the rig as to make its use prohibitive. A two-stage unit is essential to avoid having to come out of the hole when fluid levels start to rise rapidly during any minor shutdown. Two hundred feet of fluid can be blown out without difficulty if the minimum working pressure of the machine is equal to 125 psi.

5. **Value of experience:** Although basic principles of drilling with compressed air vs. mud are somewhat identical, it is true that there are not many rotary drillers who have actually worked with compressed air. Experience seems to be the best teacher; the knowledge of formations to be drilled is of tremendous help; and experience and only experience can be counted upon to be sure that the well has been properly cleaned out. Furthermore, men working together day after day, not only in drilling but in tearing down, moving, and rigging up, is all a part of speed and of lower costs. The recent addition of two-way radio equipment by the contractor, which tied in with the general headquarters at Nowata, and with the eight mobile units now in opeartion in that area, assure the minimum of shutdown time waiting for repairs, engineering advice, or for an observer to witness the chipping of the sand body.

6. **Costs to company:** As the small rig was put to work in February 1955 on an experimental basis, the company agreed to absorb all direct costs of experimentation. Obviously those costs during the first few months, which did not include any profit to the contractor, were high; but as more experience was gained and the different economies and greater efficiencies indicated previously were attained, each month reflected a reduction in costs. These costs, which now include a satisfactory profit for the contractor, are running at approximately 48 per cent of the initial experimental base cost. They are practically equal to the actual cost of drilling with company-owned cable tools and it is freely predicted that they will eventually fall below such basis costs and still provide the contractor with a reasonable profit. Although the large rig has been in operation intermittently since November 1955, it has been on such specialized type of work that any statement of costs at this point would be meaningless.

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And what a drill field! 34,000,000 net acres on which Cities Service spent over seventy million dollars for exploration and development during 1955, pushing steadily forward in the search for oil and gas.

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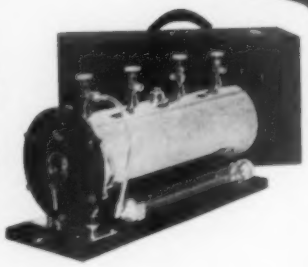

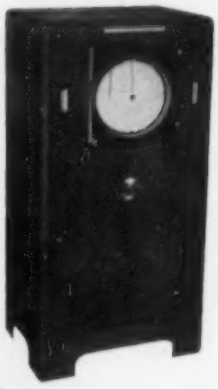

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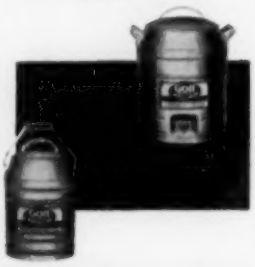

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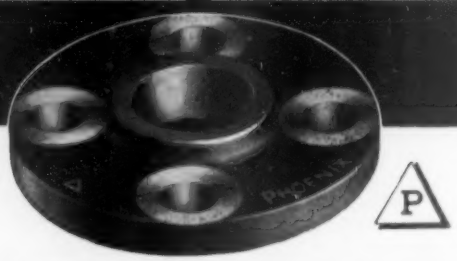

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PORTABLE-GASOLINE-PLANT SYMPOSIUM

Designing a Midget Plant for West Texas—2

by F. H. Lacy, Jr., and G. B. Evans

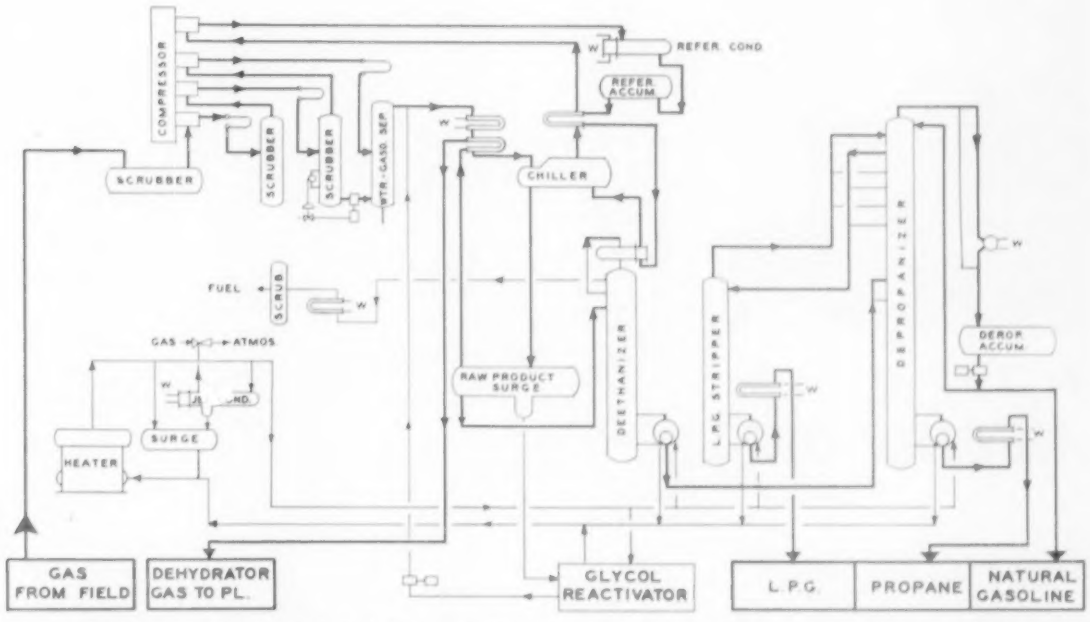
FOR the requirements of Ropes field, economics dictated the choice of a refrigeration-condensation-type plant. With three stages of gas compression (from atmospheric pressure to 500 psig.) and one stage of refrigerant compression, four compressor cylinders were required on each compressor unit if the gas and refrigeration loads were to be balanced. With a total requirement of about 660 hp., the use of more than one compressor would have required tandem cylinders on each unit to handle both gas and refrigeration loads. Therefore, only one gas-engine-driven compressor unit with three stages of compression, plus a refrigeration cylinder, was installed. The jacket-water pump for this unit and the plant-cooling water pump are both V-belt driven from the compressor engine. Through a torque-tube arrangement, the cooling-tower fan is also driven from this engine.

Authors are with Honolulu Oil Corp. Paper presented at the thirty-fifth annual convention, N.G.A.A., Fort Worth, April 11-13, 1956.

The master meter on the plant inlet stream, for economy, utilizes a Taylor Pitot-Venturi for measuring flow. Between the inlet scrubber and the first-stage suction header, a butterfly valve actuated by two pilots controls pressure. One pilot acts to prevent a vacuum on the gathering system, and the other pilot serves to keep the compressor suction pressure from rising to a value which could seriously overload the compressor engine.

First, second, and third-stage discharge gases and jacket water are air-cooled in the air section of the cooling tower. This section, utilizing air which has previously passed through the water-cooling section, is designed to cool the gases to 100° F. when ambient air is 105° F. This tower has one induced draft fan which, as mentioned, is driven from the compressor engine. The fan has controllable variable-pitch blades, with the pitch adjusted by a temperature controller located on the third-stage discharge gas from the air cooler. The pitch of the fan can actually go about 10° negative if need be.

Jacket water, as shown on the flow diagram, is temperature controlled through a by-pass arrangement. It is used to cool compressor-engine lube oil. Water from the water-cooling section of the tower is circulated through shell-and-tube units for the remainder of the plant-cooling duties. With this arrangement, only low-temperature streams are cooled with water. As a result, scaling of equipment is negligible.



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Among the Drilling Contractors

Casper Contractors Sponsor Mud Schools

The Casper Chapter of American Association of Oilwell Drilling Contractors, in cooperation with the University of Texas and state vocational training agencies of Wyoming and Montana, is sponsoring a series of seven summer drilling-mud schools for drilling engineers and field personnel in the Rocky Mountain region.

The first two schools of the series already have been held, one at Greybull, Mont., May 14, and the other at Cody, Wyo., May 28. The third is scheduled for Thermopolis, Wyo., June 11. The remaining will be at Casper, July 9; Billings, Mont., July 23; Rock Springs, Wyo., August 6; and Tioga, N. D., August 20.

New techniques in handling mud comprise the keynote theme of the schools. The course is designed as a refresher for trained engineers and an introduction to mud control for roustabouts, derrick men, drillers, and farm bosses.

C. G. Glasscock Drilling Co., Corpus Christi, Tex., has contracted for another test Republic Natural Gas Corp. is undertaking in the Pointe Au Fer area, in the coastal marshes of southwestern Terrebonne Parish, South Louisiana. It will be a 6,500-ft. job, Republic's 3 Nelson, in 2-21s-11e.

Ernie Robb is contractor on a new wildcat test V. N. Simmons, Jr., and George Dolezal, Jr., are putting down on their Government-Anderson lease, in 33-39n-78w, 2 miles southwest of Teapot Dome, south of Salt Creek field, 40 miles north of Casper, in Natrona County, Wyoming.

Holm Drilling Co., Tulsa, is on a new wildcat job 7 miles southwest of Manter, in southwestern Stanton County, in far-southwestern Kansas. It is a 5,400-ft. Morrow sand test. Drilling is for Killam & Hurd at their 1 Rorrick. Location is 2 miles northwest of Sparks pool.

Lowe Drilling Co., Midland, Tex., is starting another deep test in the newly opened Devonian field, 3 miles northeast of the Devonian producing area at Gladiola, in northeastern Lea County, New Mexico. The contracting firm is

New drilling activity in the old Edmond field, west of Edmond, in northwestern Oklahoma County, Oklahoma. In foreground, Nuckolls-Bell Drilling Co., Oklahoma City, is drilling for Blackwood & Nichols, of Oklahoma City. Visible in the background, at the left, is a rig of Webster Drilling Co., of Tulsa, drilling for Ohio Oil Co. New development is in the Bartlesville sand at 6,300 ft. The field was discovered in 1935 with production from Wilcox sand.

drilling for Ralph Lowe, principal owner of the company. The test, 1 Shell-Browning, projected to 12,500 ft., offsets the operator's discovery well, 1 Wallace.

Fletcher Drilling Co., Shreveport, has a new contract operation in the Lamar area, Franklin Parish, northeastern Louisiana. It is another Tuscaloosa test on the southwest flank of the field. E. M. Carpenter and associates are operators. Location is at 1 Wright, in 12-15n-8e. Contract is for 5,500 ft.

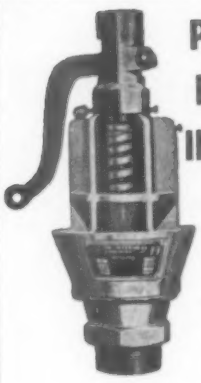
Owen Drilling Co. is the contracting firm on Texas Crude Oil Co.'s new deep test, 2 Miller et al., in the Outside Island area, Vermilion Parish, Coastal Louisiana. The test, projected to 12,000 ft., will seek to confirm oil production found by the operator's first Miller well, a location away. The oil-discovery well, completed last December, produced from 11,500 ft. The field, which previously produced gas-condensate, was discovered in March 1949.

Banner Drilling Co., Denver, has a new contract operation for U. S. Smelting, Refining & Mining Co. in the general Lindrith area, southeast of the San Juan basin gas district of Rio Arriba County, northwestern New Mexico. It is a wildcat test, 3-2 Jicarilla-Apache, in 2-23n-4w. Location is several miles southwest of Lindrith production.

True Drilling Co., Casper, Wyo., will drill a 4,000-ft. Tensleep test for Henry English at a wildcat location on Buffalo Anticline, 3 miles northwest of Norwood, in Washakie County, Big Horn basin, Wyoming. Location is on government land in 12-42n-89w.

Schoenfeld, Hunter & Kitch Drilling Co., Tulsa, has a contract with Phillips Petroleum Co. and Texas Pacific Coal & Oil Co. for a deep wildcat test to be drilled 10 miles west of Tatum, in northern Lea County, New Mexico. It will be drilled as 1 Ranger. Location, in 23-12-34, is about 3 miles southeast of East Bagley field, nearest production. Operators plan to carry the hole to 13,200 ft.

Drilling & Exploration Co., Houston, has a rig under contract to Pan American Production Co. for another deep test the latter company and Austral Oil Exploration Co., Inc., will drill in the South Thornwell area, in southern Jefferson Davis Parish, South Louisiana. The test, 3 Eddie Benoit, in 36-11s-5w, is southeast of present gas production in the area. It is scheduled to go to 15,000 ft.



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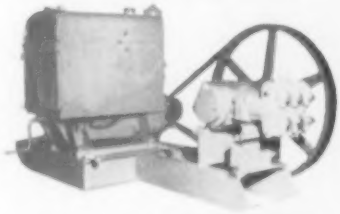

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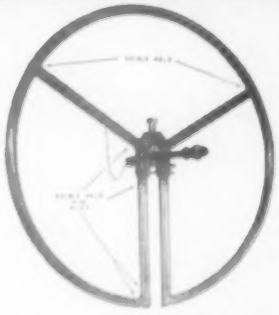

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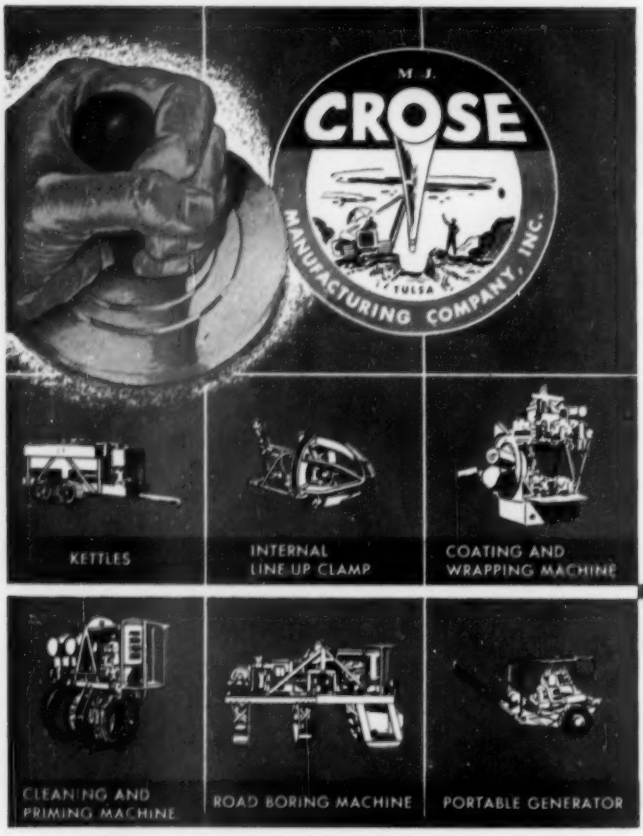

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Pipeline Patrol

. . . Report on Construction

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way. Uncontracted projects are indicated by • preceding the project.

Crude-Oil Pipelines

Buckeye Pipe Line Co.—Will complete in October or November 1956, own reconditioning of 191 miles of 8-in. from Griffity, Ind., to Lima, Ohio.

Lakehead Pipe Line Co., Inc.—Let 51 miles of 26-in. looping in Minnesota and North Dakota, to Anderson Brothers Corp. Job to be completed summer of 1956, is in conjunction with 69 miles of 24 and 26-in. looping to be completed this summer by Interprovincial Pipe Line Co. (See Interprovincial, foreign crude.)

• **Magnolia Pipe Line Co.**—Plans 36 miles of 12-in. from Andrews to Midland, Tex., to be completed January 1, 1957.

• **Offshore Gathering Corp., Houston.**—Proposes 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana.

• **Pasotex Pipe Line Co.**—Plans 127 miles of 20-in. along its route from Wink to El Paso, retiring another dual 8-in. section.

• **Shannon Oil Co., Denver.**—Plans with Farmers Union Central Exchange, Inc., and Mule Creek Oil Co., both of Billings, Mont., a 34-mile, 6-in. line from Murphy Dome in Hot Springs County, Wyoming, to contact Ohio Oil Co.'s line in Big Horn County. Construction to start in August, end by December 1, 1956.

• **Sinclair Pipe Line Co.**—Building a 300-mile line from Jacksboro, Tex., to Houston. 152 miles of 18-in. from Jacksboro to Teague, Tex., completed. Remaining 150 miles of 20-in. not yet let.

• **Tecumseh Pipe Line System.**—190 miles of 20-in. will be built by Sinclair Refining Co., Pure Oil Co., Ashland Oil & Refining Co., between East Chicago and Cygnet, Ohio.

• **Union Oil Co. of California.**—Proposes 815-mile line from Rifle, Colo., to Los Angeles refining area, to carry products from its proposed Rifle shale-oil plant.

Products Pipelines

• **American Pipe Line Co.**—Received ODM approval to amortize 40 per cent of $178,000,000 with a rapid writeoff on proposed line from Gulf Coast area to New York City area.

• **Cities Service Oil Co. & Subsidiaries.**—Plans a 10-mile, 6-in. L.P.G. line from Maysville to near Pauls Valley, Okla., to tie in to Shell line moving on to Cushing, Okla.

• **El Paso Natural Gas Co.**—Plans 240 miles of "larger than 6-in." to carry natural gasoline, butane, and propane, from its Midkiff natural-gasoline plant in Permian basin, Midland County, to El Paso. Has under way 96 miles of 8-in. in New Mexico, from its Blanco plant to its Wingate plant.

• **Gulf Refining Co.**—Will build 45 miles of 8-in. from Pontiac Eastern Corp.'s planned refinery at Hattiesburg, Miss. (due on stream May 1957) to a connection with Plantation Pipe Line Co.'s system. No date set to start.

• **Magnolia Pipe Line Co.**—Plans a 75-mile, 8-in. L.P.G. line from Hull to Texas City, Tex., and a 30-mile, 8-in. line from Andrews to Dollarhide, Tex., both to be completed January 1, 1957. Plans an L.P.G. line, 19 miles of 6-in., 3 miles of 4-in., from Beaumont to Orange, Tex. Completion date indefinite.

• **Phillips Chemical Co.**—Plans 79 miles of 6-4-in. ethylene line from Sweeny to Pasadena, Tex., to be completed December 31, 1956.

• **Phillips Petroleum Co.**—Plans 15 miles of 6-in. L.P.G. line in Sweeny, Tex., area, to be completed September 15, 1956.

• **Phillips Pipe Line Co.**—Plans 135 miles of 12-in. looping between Borger, Tex., and St. Louis, Mo., to be completed December 31, 1956.

Plantation Pipe Line Co.—Let 327 miles of 18-in. from Baton Rouge to Helena, Ala., to Oklahoma Pipe Line Constructors, to start June 1. N. L. Arie, spread superintendent, office at Baton Rouge. Completion set for December 1956.

• **Shell Oil Co., Pipe Line Department, Pacific Coast.**—Plans to convert 13 miles of existing 4-in. gasoline line, and add 3 miles of new line, to move gasoline from Wilmington refinery to Los Angeles. To be completed January 1, 1957.

• **Sioux Oil Co.**—Plans 80 miles of 4-in. from its Newcastle, Wyo., refinery to Rapid City, S. D., to be completed late 1956.

• **Southern Pacific Pipe Lines, Inc.**—Plans a 300-mile line to span the Sierras and connect San Francisco with Reno and Fallon, Nev., and to serve the Sacramento Valley.

Sun Pipe Line Co.—Contracts let on 109 miles of 14-in. from Twin Oaks, Pa., to Newark, N. J.: Sheehan Pipe Line Construction, 90 miles from Twin Oaks to Plainfield, N. J., J. W. Brown, spreadman, office at Malvern, Pa.; Delaney-Missouri Valley Construction Co., remainder. Work to start May 1, end September 1956. The line, with 83,000-bbl. capacity, will replace present 8-in. line.

• **Sunflower Pipe Line System.**—Has Kansas Corporation Commission approval for 215 miles of 6-in. to move L.P.G. from six counties in western Kansas to Wichita.

Tennessee Gas Transmission Corp.—Contracts let for 200 miles, 6-in. L.P.G. line from Banquete, Tex., to Houston: Sheppard & Geiger Construction Co., section from Banquete to Port Lavaca; Oklahoma Pipe Line Constructors, 74 miles from there to Brazos River, Gene Gohring, spread superintendent, office at Bay City; Panama-Williams Co., section into Houston.

Non-Petroleum Pipelines

• **American Gilsonite Co.**—Plans 70 miles of 6-in. from Bonanza, Utah, to Grand Junction, Colo., to carry slurry of gilsonite from mines to refinery now being built.

Pittsburgh Consolidated Coal Co.—Let to Williams Brothers, 108 miles of 10-in. from its mines in eastern Ohio to Cleveland Electric Illuminating Co.'s Eastlake power plant northeast of Cleveland. Work started April 1, 1956, on this first line to move coal, with Ford, Bacon & Davis, Inc., handling specifications, contracts, construction supervision.

Natural-Gas Pipelines

American Louisiana Pipe Line Co.—Let bulk of 1,160-mile line from North Tepetate,

LIKE A BEAVER'S DAM

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Pipeline Patrol

La., to Detroit. H. C. Price and Houston Contracting Co. have 770 miles of 30-in. from near Willow Run, Mich., to near Eudora, Ark.

Houston starts June 1 on 40 miles in Ohio, E. C. Norris, spread superintendent, office at Defiance; starts May 1 on 100 miles from east of Memphis, Tenn., working south towards Eudora, Ark., W. H. Hayes, spread superintendent, office at Collierville, Tenn.; starts May 15 on 85 miles working north from Eudora, F. A. Silar, spread superintendent, office at Eudora.

Price starts May 1 on 83 miles in Tennessee, R. L. Ezell, spread superintendent, office at Brownsville, Tenn.; 31 miles in Indiana, C. E. Shivel, spread superintendent, office at French Lick, Ind.; 83 miles in Kentucky, C. R. Ice, spread superintendent, office at Princeton, Ky.; 31 miles in Indiana, W. H. Olrich, spread superintendent, office at Edinburg, Ind.

Brown & Root has 221 miles of 30-in. from North Tepetate to Arkansas-Louisiana border (which is subcontracted to Sharon, Allen, Gay & Taylor, Inc.—formerly Associated Pipe Line Contractors—and Western Contractors), and 39 miles of 16-in. under-water line which it will lay itself. Western Contractors expects to complete its 100 miles August 1956. W. B. Williams, spread man, office at Eunice.

Has FPC permit for 117 miles of 22-in. from Payne, Ohio, to Bridgman, Mich.

• **Arkansas Louisiana Gas Co.**—Has long-range plans for line from Texas-Louisiana coastal region to northern Louisiana, to connect with their present system.

Atlantic Seaboard Corp.—Williams-Austin Co. has under way 50 miles of 24-in. from Hardy County, South Virginia, to Greene County, Virginia, O. L. Martin, spread man, office at Elkton, Va.; and 37 miles of 26-in. loops along the Cobb-Rockville line in West Virginia. Ralph Gaddy, spread man, office at Elkins, W. Va., both to be completed November 1, 1956.

• **Carolina Pipeline Co.**—Applied for South Carolina Public Service Commission permit to distribute gas in central South Carolina. Plans lines to 14 cities. Will buy gas from Transcontinental Gas Pipeline Co. or Southern Natural Gas Co.

Cascade Natural Gas Co.—Engineering Construction Co. started April 1, 1956, laying 400 miles of ¾ to 12-in. distribution lines in Yakima, Grandview, Granger, Trosper, Sunnyside, Toppenish, Union Gas, Wahpato, and Zillah, Wash., to complete August 1, 1956. Jim Harty and Jim Underwood, spread men, office at Yakima.

Cities Service Oil Co. & Subsidiaries.—M. L. Moore Construction Co. has 18 miles of 3 to 10-in. gathering system at Roberts Ranch near Odessa, Tex., to be completed June 15, 1956.

• **Coastal Transmission Corp.**—Applied to FPC for 565 miles of 22-26-in. from McAllen, Tex., to Baton Rouge, to deliver to Houston Texas Gas & Oil Co.'s proposed line to Florida. Plans 272 miles of smaller gathering lines.

• **Colonial Natural Gas Corp.**—Proposes two systems: One between Houston-Lake Charles area and Miami, Fla.; one in the Carolinas and Georgia.

• **Colorado Interstate Gas Co.**—R. H. Fulton has 238 miles of 22-in. from Laramie to Green River, Wyo. (last part of a 374-mile line between Denver and Rock Springs), to be completed fall 1956. Filed, March 29, for FPC permit for 1957 program: 307 miles of 30-in. from Idalia, Colo., to Beatrice, Neb., to take gas from a planned 165-mile, 26-in. line from near Carr, Colo., to Idalia, and from a 72-mile, 26-in. line from near Kit Carson, Colo. to Idalia; 215 miles of 20 and 24-in. to parallel present line from Texas Panhandle area to Kit Carson; 34 miles of 16-in. from Keyes field, Oklahoma, and Greenwood field, Kansas, to the new north-south line.

El Paso Natural Gas Co.—Has under way 193 miles of 34-in. between San Juan basin and Topock, Ariz., and 38 miles of 20-in. between San Juan mainline and Phoenix, both to be completed February 1, 1957. Western Pipeline, Inc. has under way 146 miles of 34-in. between San Juan basin and Topock, to be completed February 1, 1957, and 112 miles of 20-in. between San Juan mainline and Phoenix, to be completed November 1, 1956. El Paso also has under way 34 miles of 24-in. from Ignacio, Colo., to the Blanco plant, to be completed October 1, 1956.

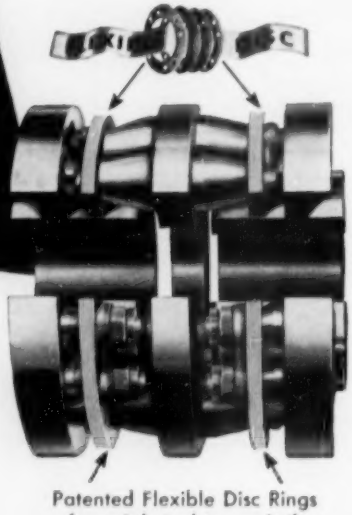
• **Empire Southern Gas Co.**—Plans a 10-mile, 8-in. line, and 5 miles of 4 in. gathering lines in Gray County, Texas, to be completed August 15, 1956. Plans a 4-mile, 8-in. loop south out of Pampa, Tex., on transmission line, and a 9-mile, 8-in. loop northwest out of Big Spring, Tex., on transmission line, to be completed September 1, 1956.

• **Houston Texas Gas & Oil Co.**—Applied to FPC for 960 miles between Baton Rouge and Miami: 507 miles of 30-in., 157 miles of 26-in., 61 miles of 20-in., 224 miles of 18-in., 12 miles of 12-in. Plans 500 miles of sales laterals in Florida, with main line joining Coastal Transmission's proposed line from McAllen, Tex., to Baton Rouge.

• **Iron Ranges Natural Gas Co., St. Paul.**—Applied to FPC for a 68-mile transmission line and 47 miles of laterals to supply towns on the Mesabi Iron Range, Minnesota.

• **Kansas-Nebraska Natural Gas Co., Inc.**—Plans 11 miles of 12-in. from Colby to Oakley, Kans., to be completed August 1956. Plans 10 miles of 10-in. and 10 miles

Specify THOMAS ALL METAL FLEXIBLE COUPLINGS for Power Transmission to avoid Costly Shut-Downs



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Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.

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FACTS	EXPLANATION
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NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
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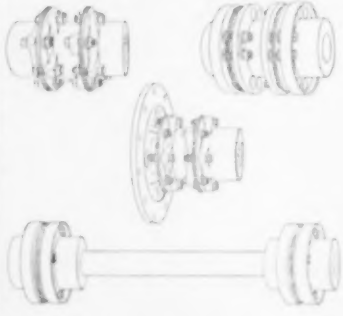
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



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The case of the traveling triplex pump

This truck-mounted National triplex pump is paying off for one of our customers in Kansas. Used for sand frac service and washing wells on an extensive waterflood property, it's the first of three such portable F-90 pumps to be put into action.

And the action is fast. Like a National portable rig, this pump can be quickly moved between well sites. Its mobility and its dependable operation insure economical servicing.

This pump has been used on wells ranging from 500 to 1,000 feet, and at 1400 to 2,000 psi formation breakdown pressures. The injection rate is 6½ barrels per minute at 750 to 1,000 psi, using sand and crude oil as injection material. For well washing, water is circulated at a 3 to 4 barrel per minute rate, at 1,000 psi for 1 to 3 hours. So far, this "traveling pump" has completed service on more than 40 wells—and the customer is very satisfied with its dependable operation.

On the next two pages, you'll find the reasons why National Triplex Pumps perform profitably *wherever* you put them to work. In this respect, they are typical of the complete line of quality drilling and production equipment bearing the National Blue label. You can get full information—along with alert supply service—on this line at the National Supply Store in your area.

THE
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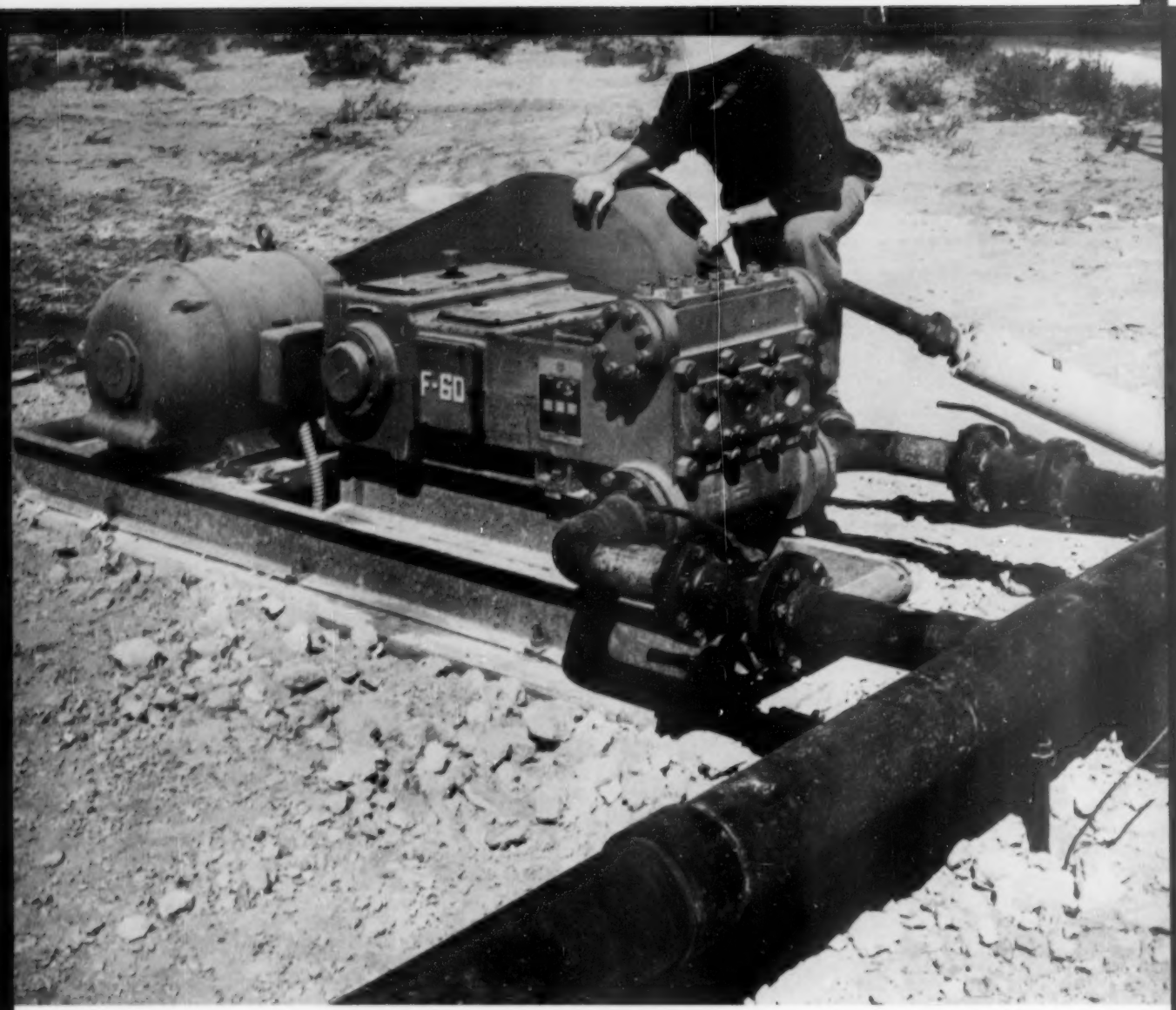


NATIONAL TRIPLEX PUMPS ARE PROFITABLE

Waterflooding is just one of the many jobs you can do profitably with National Triplex Pumps. They're equally effective for salt water disposal, high pressure testing, formation fracturing and acidizing, and as power-oil sources for sub-surface hydraulic systems. And wherever you put them to work, they deliver dependably—with little or no service downtime.

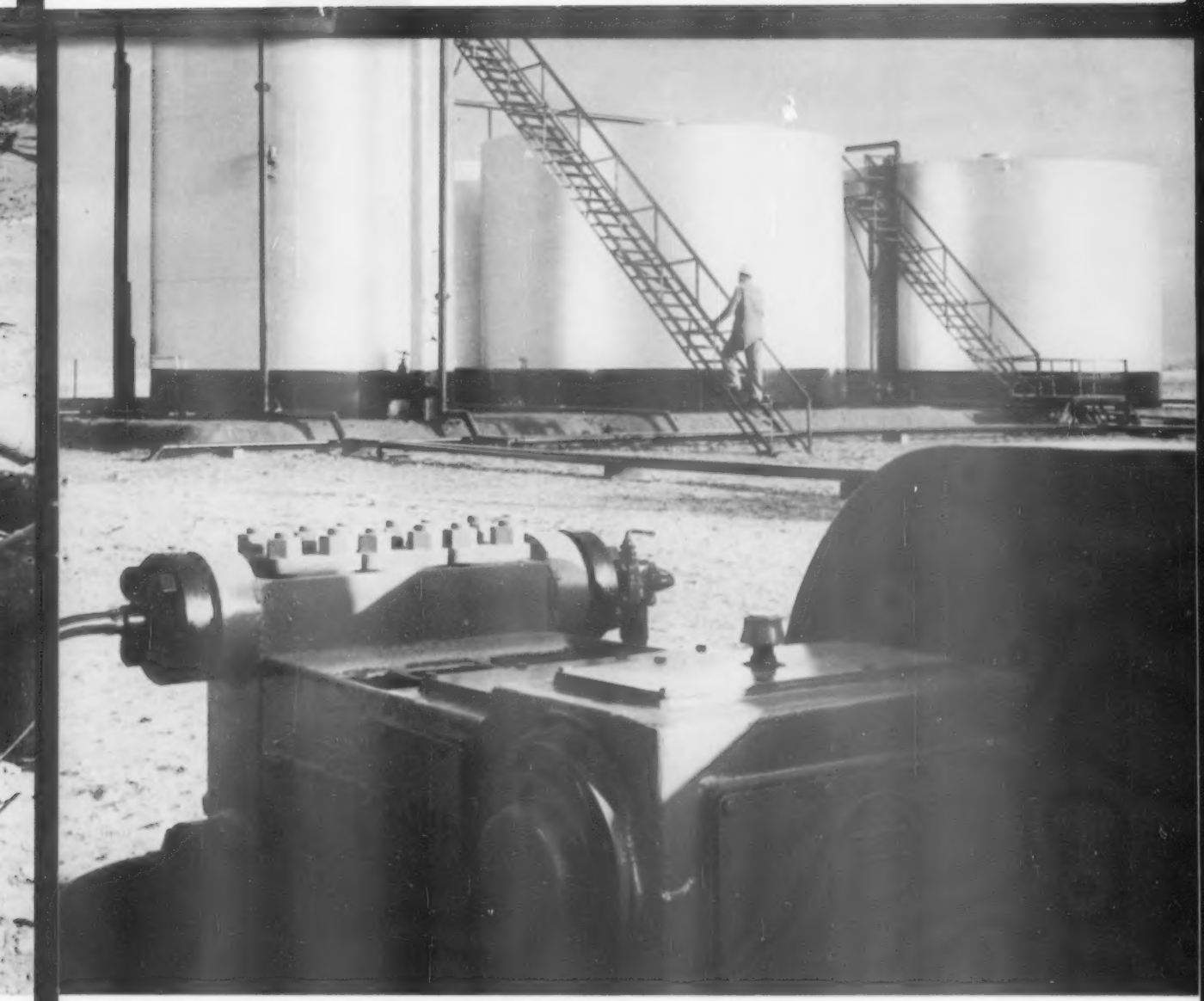
Simplified, rugged construction insures their sound performance, and their compact design requires a minimum of space. National Triplex Pumps have heavy-duty housings and frames, long-life bearings, stainless steel valves, National's time-proven lubrication systems, and a minimum of wearing parts.

Plungers, fluid ends and stuffing boxes are interchangeable, thus providing the flexibility to meet varying pressure and volume needs. They are also available for either corrosive or non-corrosive service.

You'll find, too, that National Triplex Pumps are easy to install and maintain. They're adaptable to V-belt or direct drive, and are easily fitted to unitized skid mounting for complete portability. For minimum maintenance and speed in plunger size changeover, these pumps have easily removable cartridge-type stuffing boxes.*

These are just a few of the reasons why National Triplex Pumps pay dividends on many oilfield and petrochemical pumping jobs. The National Supply field representative in your area will be glad to give you more information. Ask him soon.

*Patent Pending



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Model Number	Rated Discharge Pressure Range*	Barrels Per Day Range*
F-15-L (Low Pressure)	500 to 825 psi	430 to 1770
F-15-M (High Pressure)	1120 to 2520 psi	140 to 785
F-60-L (Low Pressure)	835 to 1575 psi	1120 to 4230
F-90-L (Low Pressure)	685 to 1345 psi	1955 to 7715
F-60-S (High Pressure)	1575 to 4975 psi	355 to 2240
F-90-S (High Pressure)	1660 to 5375 psi	480 to 3190

*Based upon standard pump speeds and rated HP output

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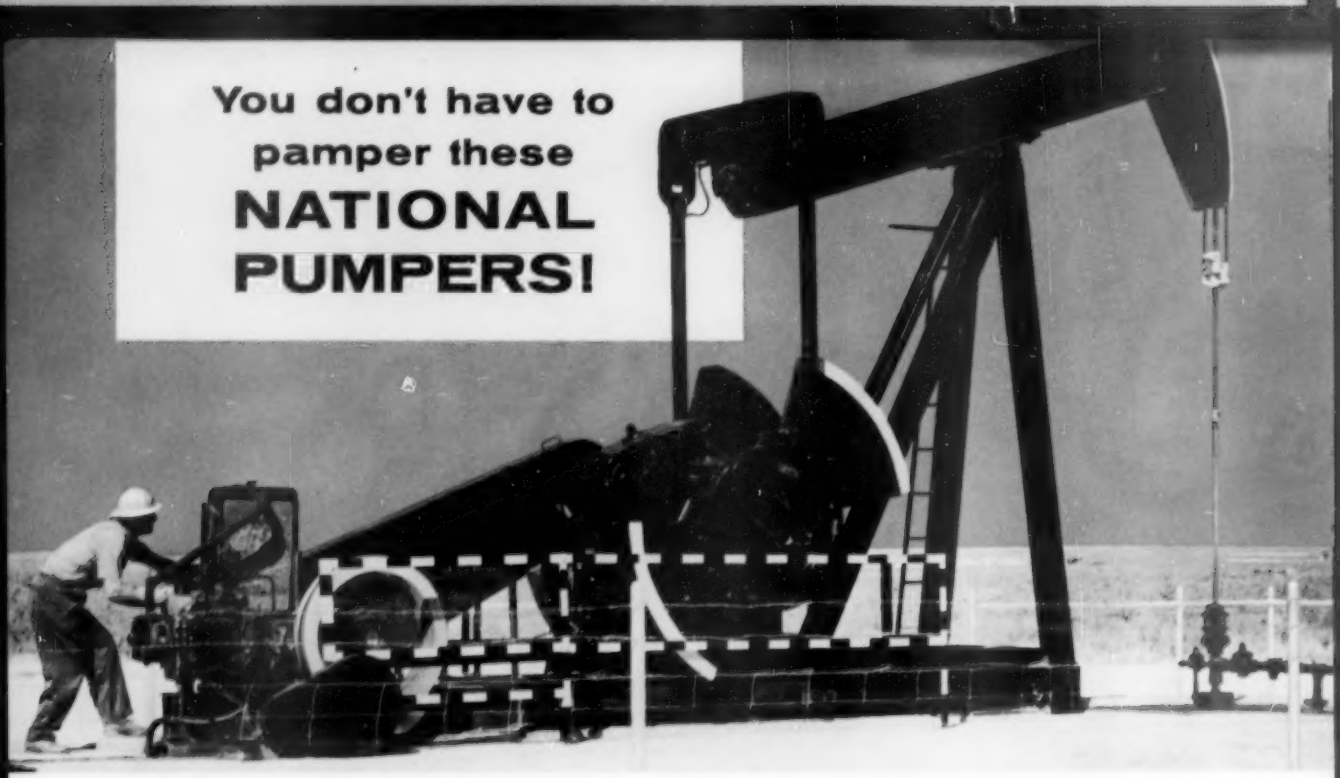

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- **Exceptionally stable, well balanced samson post.**
- **Pitman assembly features easy maintenance, fast assembly.**
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Get the complete facts on National Pumpers today. For the full story on the high performance and low operating costs they offer, see the National Supply Store men or representatives in your area soon. New bulletins describing these quality pumping units are available.

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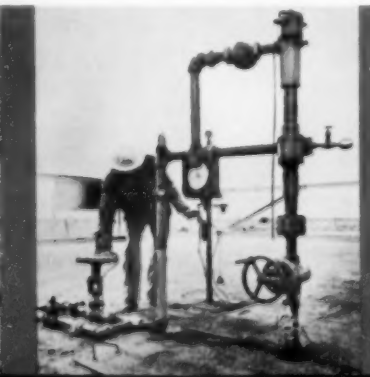
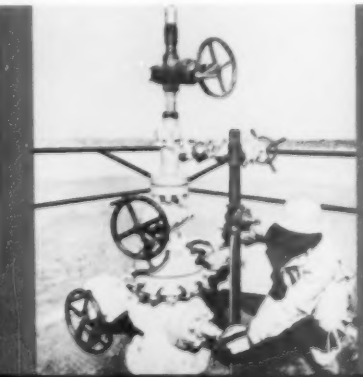
NATIONAL Plunger Lift

This National unit uses either formation gas or injected gas pressure for operation. Under the proper conditions, this method of operation can be exceedingly economical.

NATIONAL Wellhead Equipment

Interchangeable units provide many combinations to meet your specific needs in size, capacity and type. Ease of assembly and pre-tested safety are two major features of this equipment.





Pipeline Patrol

of 8-in. from Grand Island to Albion, Neb., to be completed November 1956. Plans 30 miles of 4-in. laterals to Eckley and Wray, Colo., to be completed July 1956. Seeks FPC permit for 12 miles of 12-in. to replace existing 8-in. between Scott City and Oakley, Kans.

• **Lone Star Gas Co.**—Has two plans before FPC to enlarge system in Texas and Oklahoma: one is a 230-mile line from Cotton County, Oklahoma, to Fritch, Tex.; one is a 205-mile line from Snyder, Tex., to a hookup with the Cotton-Fritch line. Plans are attempt to keep Natural Gas Pipeline Co. of America from building line from Wise County, Texas, to Fritch.

Michigan Consolidated Gas Co.—Somerville Construction Co. has under way 67 miles of 10 and 12-in. between Sears and Travers City, Mich., Floyd Huduall, superintendent, office at Cadillac. Somerville, jointly with H. L. Gentry Construction, has under way 60 miles of 10 and 12-in. between Muskegon and Ludington, Mich., Frank Morris, superintendent, office at Hart.

• **Michigan Wisconsin Pipe Line Co.**—Has FPC permit for 252 miles of 24, 18, 12, 6, and 4-in. loops in Wisconsin, to be completed November 1956.

Latex Construction Co., jointly with Houston Construction Co. and H. C. Price Co., has 90 miles of 16 and 20-in. between Milwaukee and Oshkosh, to start June 25 and complete October 1, 1956, John Phipps and U. J. Davenport, spread men.

• **Midwestern Gas Transmission Co.**—Will build a main line from Portland, Tenn., to Canadian border near Emerson, Man.; 829 miles of 24-in., 109 miles of 16-in., 174 miles of 12-in. Plans 648 miles of 3 to 18-in. extensions in Minnesota and Wisconsin, pending FPC approval.

• **Natural Gas Pipeline Co. of America.**—Has FPC approval for 350 miles of 20 and 26-in. from Jack and Wise counties, Texas, to Fritch, Tex., which will be contested by Natural Gas Pipeline and Lone Star Gas Co. Filed for FPC permit for a 389-mile, 36-in. loop along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co. Also for 91 miles of 30-in. looping to be laid along parts of its main line. R. H. Fulton & Co. has under way 25 miles of 12-in. laterals and 18 miles of various size gathering lines in Gray and Roberts counties, Texas, to be completed July 14, 1956.

Nevada Natural Gas Co.—Engineers Limited Pipeline Co. has 125 miles of 12 and 16-in. between Las Vegas, Nev., and Topock, Ariz., to complete June 1956, "Ham" Hamilton, superintendent, office at Needles, Calif.

New York State Natural Gas Corp.—Williams-Austin Co. has 17 miles of 30-in. from Caton to Horseheads, Steuben County, New York, to start July 9, 1956. Harford Brothers has 27 miles of 20-in. from Elk County to Clearfield County, Pennsylvania, to be completed June 15, 1956.

Niagara Mohawk Power Corp.—Let to various contractors, 275 miles of 2 to 12-in. distribution mains for growth of service areas in Central, Eastern, and Northern New York, to be completed December 31, 1956.

• **North Carolina Natural Gas Corp.**—This subsidiary of Colonial Natural Gas Corp. has permit from North Carolina Utilities Commission for 575 miles of 3 to 16-in. from Transcontinental Gas Pipe Line Corp.'s system near Mooresville, eastwardly across North Carolina.

• **Northern Natural Gas Co.**—Applied to FPC to add 348 miles of main line, 307 miles of branch lines in Wisconsin, Minnesota, South Dakota, and Iowa. Main lines include 169 miles in Duluth-Superior area, 164 miles in Aberdeen area of South Dakota. Proposes 73 miles of 20-in. from Savanna Creek to Pincher Creek fields in Alta., Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.

• **Offshore Gathering Corp., Houston.**—Seeks FPC permit for 364 miles in Gulf of Mexico off Louisiana: 60 miles of 24-in.; 70 miles of 26-in.; 234 miles of 30-in.

• **Pacific Gas & Electric Co.**—Will build 37 miles of 20-in., 37 miles of 18-in., 9 miles of 12-in. from Beehive Bend field near Willows, Calif., to near Davis, then to Sacramento. Has under way a 6-mile gathering system at Beehive Bend. Also plans to loop the Topock-Milpitas line with 135 miles of 34-in., laying major part in 1956, and 62 miles in 1957.

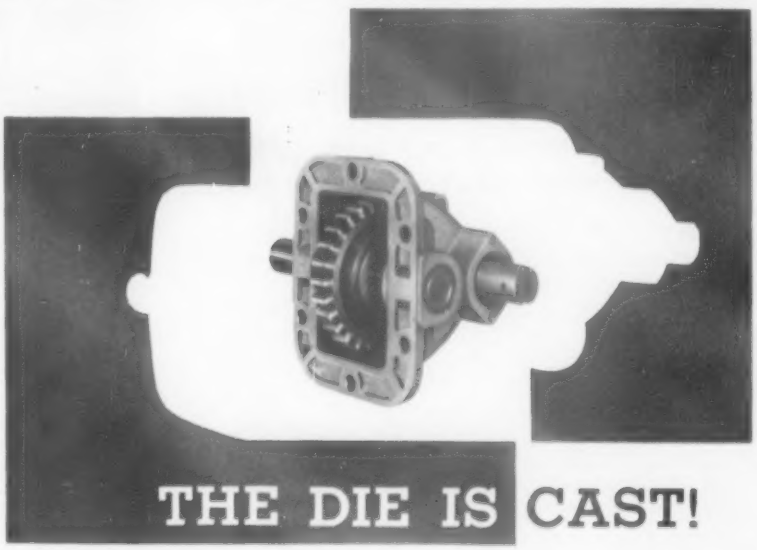
• **Pacific Northwest Pipeline Corp.**—Has FPC permit for 37 miles of 6-in. from Dove Creek, Colo., to Nucla, and 13 miles of 4-in. from Nucla to Uravan, to serve Union Carbide Nuclear Co. and Vanadium Corp. of America. Contracts let on other trunk and sales laterals:

A. P. V. Co., Inc., 81 miles 26-in. between Plymouth and Goldendale, Wash.

Engineers Limited, Inc., 55 miles 26-in. between Goldendale and Stevenson, Wash., to complete July 1956, Louis Robertson, superintendent, office at White Salmon.

Midwestern Constructors, Inc., 79 miles of 26-in. from Skamania to Toledo, Wash., to be completed July 1, 1956. M. T. Wilhite, spread man, office at Camas, Wash.

River Construction Corp., 64 miles 26-in. between Toledo and Tacoma, to be completed August 1, 1956, Vernon Gayhart,



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The die-cast aluminum housing makes this NEW TULSA power take-off "light as a feather" . . . gives it all the strength and durability for which the TULSA line is famous. Output shaft rotates on two needle bearings and is manufactured in three sizes—13/16", 7/8" and 15/16". It's available with either cable or lever control. Designed and built to cover the full market range of a thoroughly dependable, low priced, single speed power take-off for medium duty work. Same nationwide distribution and service as offered for the full TULSA line of power take-offs.

Tulsa Winch
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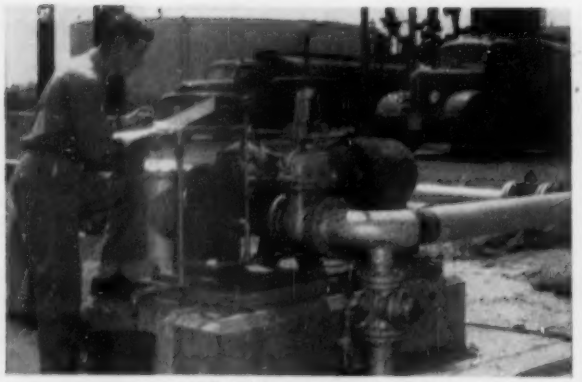


A 6" double suction Goulds pump in the Norfolk, Va., plant of Cities Service Oil Company.

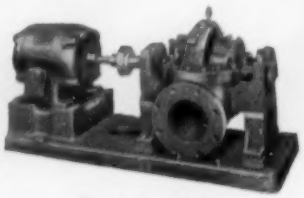
They chose pumping capacity

Here's how you can get capacity...or head...or both

CAPACITY: When Cities Service Oil Company outfitted their Norfolk Terminal with pumps, their prime interest was capacity.

They needed a pump that could service four truck-loading assemblies, tank cars and small boats, swiftly and dependably.

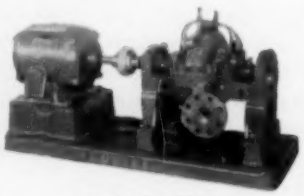
They chose the 6" model of this single stage suction pump. It gives them a full 1,100 GPM under a 60-foot head. The largest of the 19 pumps in this series pumps 6,400 GPM under a 280-foot head.



Goulds Fig. 3405

HEAD: If you're looking for greater pressure rather than just capacity, there are five models of Goulds Fig. 3305 two stage pump that provide heads up to 1,000 feet with capacities to 1,200 GPM.

BOTH: If you're looking for both head *and* capacity, either in combination or for different jobs, you have 24 models to choose from. Since most parts are interchangeable among the different pumps, you can cut parts inventory by as much as one-half or even more.



Goulds Fig. 3305

There are many other problem-solving features in these pumps. To get the complete picture send for: Bulletin 721.6 on the single stage pump and Bulletin 722.6 on the two stage.

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These inexpensive digital pulse-code systems can be provided for the measurement and control of any number of tanks.

The systems receive and display on lamp registers the tank liquid levels in feet, inches and eighths by tank number. Averaging temperature read-out can be provided for each tank. The systems can scan several tank farms automatically. Duplicate receiving equipment, including electric typewriter or punch card read-out, can be installed in several locations.

Write Pacific Division, Bendix Aviation Corp., Department 832, North Hollywood, Calif., for Bulletin ES-5A or contact Instruments, Inc., P.O. Box 556, Tulsa, Oklahoma.

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In addition to Tank Gauging Systems Bendix-Pacific offers the complete Electro-Span line of high accuracy digital Data Transmission Systems for all remote measurement and remote control purposes. Our application engineers will gladly propose a system to meet your specific requirements.

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Bendix PACIFIC DIVISION
Bendix Aviation Corporation
NORTH HOLLYWOOD, CALIF.

Export—Bendix International: 205 E. Forty-second Street, New York 17.

Pipeline Patrol

spread man, office at Vancouver, Wash.; also 16 miles of 18-in. out of Portland, Ore., completed.

B & M Construction Co., 53 miles 26-in. between Tacoma and Duvall, Wash.

Curtis Construction Co., 87 miles 26-in. between Duvall and Sumas, Wash.

Hood Construction Co., 31 miles 6-in. near Walla Walla, Wash.

R. H. Fulton & Co., 156 miles 20 and 16-in. lateral from main line to Spokane; also 129 miles of laterals into Idaho.

Eastern Pipeline Contractors, 137 miles of 6, 8, 10-in. laterals from Plymouth to Wenatchee, Wash., to be completed July 1, 1956, L. Visentine, spread superintendent, office at Yakima.

• **Permian Basin Pipeline Co.**—Has FPC permit for 19 miles of 16-in. in Andrews County, Texas.

Phillips Petroleum Co.—Vaughn & Taylor and McVean & Barlow have 325 miles of 24 to 2-in. gathering line in West Texas, to be completed July 1, 1956.

• **Piedmont Gas Co., Hickory, N. C.**—(Parent is Carolina Natural Gas Corp.) Seeks FPC permit for 78 miles of 2 to 8-in. extension off Transcontinental in North Carolina, to serve Gaston, Lincoln, Catawba, Caldwell, and Burke counties.

Portland Gas & Coke Co.—United Engineers & Constructors, Inc., of Philadelphia, has engineering contract for 80 miles of various size lines up to 16-in.

Signal Oil & Gas Co.—C. P. Bartley & Son has 70 miles of 2 to 16-in. gathering system near Tioga, N. D., to be completed September 1, 1956. C. P. Bartley, Jr., and Lawrence Barto, spread men, office at Tioga.

South Atlantic Gas Co.—Latex Construction Co. has 10 miles of 12, 10, and 4-in. near Savannah, Ga., to complete June 15, 1956, Foy Johnson, superintendent, office at Savannah.

• **Southern California Gas Co. and Southern Counties Gas Co. of California.**—Have permit for 326 miles of 30-in. from Topock, Ariz., to Newhall, Calif., to start November 1956. Will also build 41 miles of 30-in. from Newhall to Alhambra, Calif., to start early June 1956.

• **Southern Natural Gas Co.**—Has temporary FPC authority for 39 miles of loops near Atlanta, Ga.

• **Tennessee Gas Transmission Co.**—Projects:

192 miles of 24-in., 34 miles of 20-in., 15 miles of 18-in., 110 miles of 4, 6, 8, 10, and 12-in. laterals to extend gathering system from west of Crowley, La., to tie in to Tennessee Gas gathering line, eastward across southeast Louisiana, to mouth of Mississippi River, with laterals extending into Gulf of Mexico.

Contracts let: Houston Contracting Co. has completed 75 miles of 24-in. in southern Louisiana; and has 60 miles of 8, 10, 12-in. laterals south of Morgan City, to be completed June 15, spread superintendent, M. L. Thompson.

Williams Brothers Co. has 55-mile, 24-in. marine job from Cocodrie, La., east of Bay Chalon area, spread man, W. A. Briley.

Grayco Constructors, Inc., Sharman, Allen, Gay & Taylor (formerly Associated Pipe Line Contractors, Inc.), and Collins Construction Co. have remainder.

Has FPC permit for 74 miles of 30-in. looping from Cave City to Danville, Ky., and for 147 miles of 26-in. looping from east of New Boston, Ohio, and north of Ohio River to McConnellsville, and from Newcomerstown to Lisbon, Ohio, both to be completed fall of 1956.

H. C. Price Co. has 82 miles of 26-in., G. A. Reutzel, spread superintendent, office at Chauncey, Ohio.

Applied for FPC permit for 63 miles of 30-in. looping from Scottsville, Ky., to Cave City, and from southwest of Danville to northeast of Danville; for 99 miles of 26-in. looping from Greenup, Ky., to north of Ohio River, from McConnellsville to Newcomerstown, and from Lisbon, Ohio, to near Mercer, Pa.; for 100 miles of 4, 6, 8, 10, and 12-in. gathering line in Texas-Louisiana Gulf Coast area.

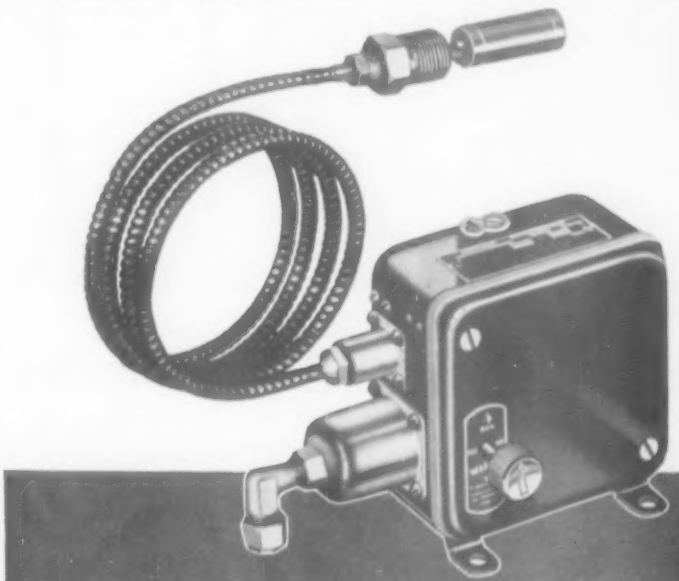
Tennessee Natural Gas Lines, Inc.—Walters & Prater has 9 miles of 12-in. looping including Cumberland River Crossing, Tenn., to be completed July 1, 1956.

Texas Eastern Transmission Co.—Applied to FPC, December 1955, for 422-miles of 30-in. from McAllen to Beaumont, Tex., to move imported Mexican gas. Applied for 530 miles of 30-in. looping from Kosciusko, Miss., to Uniontown, Pa. Will lay 45 miles of 24-in. from Provident City, Tex., to connect in Matagorda County, Texas, to tie the Wilcox Trend Gathering System with the extension from Mexico.

• **Texas Gas Transmission Corp.**—Plans 110-mile, 20-in. from Assumption Parish to near Eunice, La. Will also lay 40 miles of various size pipe along main line from Louisiana to Illinois. Both to be completed December 1956. Plans 53 miles of 30-in. from Chicot, Ark., to Clarksdale, Miss., to be completed September 1, 1956. Plans reconditioning of 21 miles of 18-in. line near Wilmot, Ark., and Clarksdale, Miss., to be completed October 1, 1956.

• **Trans Carolina Pipe Line Corp.**, Commercial Building, Raleigh, N. Car.—Seeks FPC permit for 300-mile system across North and South Carolina, plus 500 miles of laterals.

• **Transcontinental Gas Pipe Line Corp.**—



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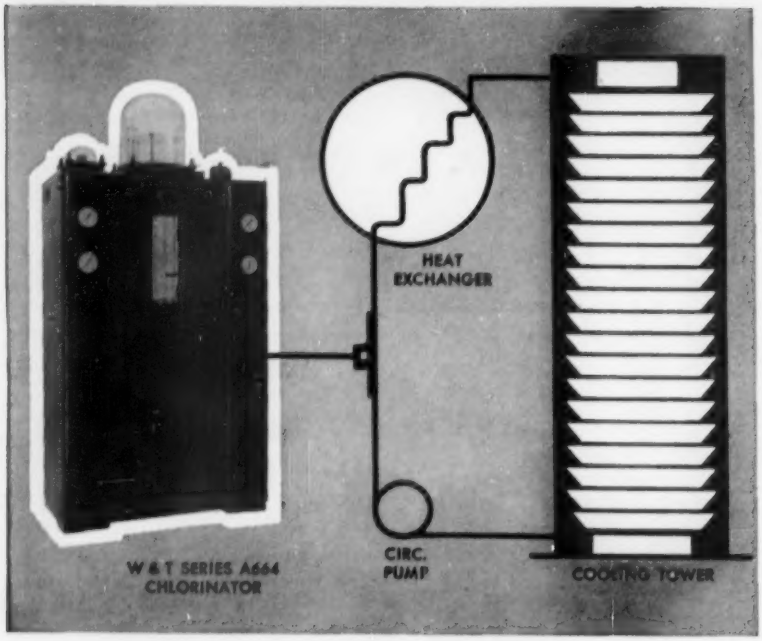

...Chlorination of Cooling Water Circuits

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Has applied to FPC to lay 160 miles of 36-in. and 68 miles of 30-in. loops from Louisiana to Pennsylvania., to be completed December 1, 1956.

Winchester and Vienna, Ill., Cities of—M. L. Hulcher Co., Inc., has 21 miles of 8-in. for Winchester, to complete September 30, 1956, Rolfe, superintendent; has 10 miles of 4-in. for Vienna, to complete August 15, 1956, Wilkerson, superintendent.

Foreign Crude-Oil Pipelines

Arabian American Oil Co.—Firm is building a 140-mile, 20 and 22-in. line from Safaniya field to Ras Tanura.

• **Canadian Gulf Oil Co.**—Seeks approval for 35 miles of 8-in. to connect Drumhell field, Alberta, with existing Gulf lines running to Edmonton.

Cremona Pipe Lines, Ltd.—Dutton-Williams Brothers, Ltd., has 60-mile, 8-in. line from Sundre-Westward Ho region to Calgary, to be completed August 1956. Company is subsidiary of Home Oil Co.

Creole Petroleum Corp.—Williams Brothers Sudamericano, Ltd., has under way 15 miles of 34-in. from Pueblo Viejo to Lagunillas, Venezuela, to be completed August 1, 1956.

• **Gulf Italia Co.**—Will complete late summer 1956, 35 miles from its Ragusa field in southwestern Siciliy to RASIOM's refinery at Augusta.

Interprovincial Pipe Line Co.—Let to Majestic Contractors, Ltd., 69 miles of looping along present system from Alberta to Sarnia, Ont., to be completed August 31, 1956: 67 miles of 24-in. between Carroll and Somerset, Man.; 2 miles of 26-in. between U. S. border and Gretna pumping station.

Has applied to Board of Transport Commissioners for 150 miles of 20-in., an extension of its line from Sarnia to the Toronto refining area. If approved, work will start spring, 1957, end that fall.

Peace River Oil Pipe Lines, Ltd.—Dutton-Williams Brothers, Ltd., has 35 miles of 8-4-in. gathering system at Sturgeon Lake, Alta., to be completed June 1956. J. M. McCartney, spread man, office at Valleyview.

Fulton Banister, Ltd., has contract to coat and bury 45 miles of 12 and 16-in. from Valleyview to Edson, Alta. (Line was welded above ground last year.) Jerry Nash is superintendent, office at Valleyview.

Pembina Pipe Line, Ltd.—Sparling Davis Co., Ltd., has 100 miles of 3 to 10-in. gathering system in Pembina field.

Mannix, Ltd., has 200 miles of 3 to 12-in. gathering lines in Pembina field, F. Whitlow, superintendent, office in Pembina field.

PEMEX.—Constructora El Aguila, S. A., has 50 miles of 20-in. from Angostura to Veracruz, Antonio Sanz Polo, spread man, office at Veracruz.

• **Sinclair Oil Corp. and Socony Mobil Oil Co.**—Will build 211 miles of 20-in. from the Silvestre field in Barinas, Venezuela, to Puerto Cabello on Caribbean Sea.

• **South Saskatchewn Pipe Line Co.**—Plans 58 miles of 12-in. from Cantaur field to Dollard field in Saskatchewan, to start in July, end September 1956.

Westspur Pipe Line Co.—Majestic Contractors, Ltd., has 109 miles of 12-in. from Midale, Sask., to Interprovincial Pipe Line Co.'s pump station at Cromer, Man., and 50 miles of various size gathering lines in Midale-Frobisher area, to complete fall 1956.

Yacimientos Petroliferos Fiscales (Argentina).—Has started 700 miles of 12-in. from Campo Duran to San Lorenzo. TECHINT, (Compania Tecnica Internacional), Buenos Aires, has 90 miles.

Yacimientos Petroliferos Fiscales Bolivianos (Y.P.F.B.)—Williams Brothers Co. has 160

Pipeline Patrol

miles of 10-in. and 43 miles of 8-in. from Sicasica to Arica on the Chilean coast, to be completed December 1957.

Foreign Products Pipelines

• **Canadian Hydrocarbons, Ltd., Winnipeg**—Proposes 800-mile LPG line from Edmonton, Alta., to Winnipeg.

• **Estrada de Ferro Santos a Jundial Departamento Oleoducto.**—Plans 6 miles of 14-in. from the Capuava Refinery to Utinga Terminal, to be completed December 1956.

• **Imperial Oil, Ltd.**—Will lay 38 miles of 12-in. loop along present line from Waterdown, Ont., to Toronto.

• **Iraq Petroleum Co., Ltd.**—Plans 75 miles of 24-in., 180,000-bbl. daily capacity, from Homs, Syria, to Tripoli, Lebanon.

National Iranian Oil Co.—Contracts let on 573 miles of 10-in., 40,000-bbl. daily capacity, from Ahwaz to Teheran, Iran; Constain-John Brown, Ltd., London, and Williams Brothers Co., started February 1956, laying southern 337 miles; Enterpose of Paris, has northern 236 miles.

• **North Atlantic Treaty Organization (NATO).**—Laying 2,000 miles of lines to airfields in parts of Europe. Sharman, Allen, Gay & Taylor, Inc. (formerly Associated Pipeline Contractors, Inc.), has 450 miles from Iskenderun, Turkey, to Batman. TECHINT (Compagnia Tecnica Internazionale), Milano, Italy, has 205 miles of 4-in. from Bandirma to Eskisehir, Turkey, and 250 miles of 8-in. from Antalya to Eskisehir. Bids were taken in January 1956, on 300 miles of 12-in. between Marseille and Langres, France.

PEMEX.—Constructora El Aguila, S. A., has 155 miles of 12-in. from Tampico to Cd. Victoria, Geronimo Aviuchastegui, spread man, office at Tampico.

Yacimientos Petrolliferos Fiscales Bolivianos (Y.P.F.B.)—Williams Brothers Co. has 190 miles of 4-in. from Camiri to Santa Cruz, to be completed December 1956.

Foreign Natural-Gas Pipelines

• **Alberta Gas Trunk Line Co.**—Plans 547 miles of gathering system for the Trans-Canada line: 219 miles, to be completed in 1956, near Saskatchewan and including Pincher Junction, Provost, Bindloss, Sibbald, Oyen, Sunnynook, Steveville, and Cessford; 328 miles, to be completed in 1957, will include Countess, Duchess, Princess, Homglen-Rimbey, and Nevis.

Andes Pipeline Corp.—This subsidiary of Glenn McCarthy, Inc., will build and operate 500 miles of 12-in. from McCarthy's Bolivian concession to the Chile copper mining area.

Attock Oil Co.—Plans 60 miles from Dhulian field to Rawalpindi in West Pakistan.

B. C. Electric Co., Ltd.—Mannix, Ltd., has 45 miles of 18 and 20-in. between Huntingdon, B. C., and Vancouver, G. Lyons, superintendent, office at Langley.

Cia. Shell de Venezuela.—Plans 177 miles of 20-in. from La Paz field in the Maracaibo district, to the Cardon refinery on Paraguana Peninsula, to fuel refinery furnaces. To be completed in 1957.

• **Empresa Nacional del Petroleo.**—30 miles, 10-in., planned, Concon to Santiago, Chile.

• **Estrada de Ferro Santos a Jundial Departamento Oleoducto.**—Plans 16 miles of 6-in. from Cubatao refinery to Elcloro plant, to be completed December 1956.

• **Gas Industrial de Monterrey.**—Plans 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey in northern Mexico.

Imperial Oil, Ltd.—Has let 65 miles of 4 to 16-in. gathering system in Redwater area of Alta., to Majestic Contractors, Ltd.

• **Magna Pipeline Co.**—Plans to complete fall 1956, an underwater line from Anacortes or Bellingham, Wash., to Victoria.

Mid-Western Industrial Pipe Lines, Ltd.—Dutton-Williams Brothers, Ltd., has 36 miles of 10-in. from Alexander Indian Reservation to Lake Wabamun, to be completed June 1956, L. A. Stewart, spread man, office at Onoway, Alta.

North Canadian Oils, Ltd.—Dutton-Williams Brothers, Ltd., has 136 miles of 10-in. from Lake Wabumun to Hinton, Alta., to be completed August 1956, L. A. Stewart, spread man, office at Onoway, Alta. Crossings of the McCleod River, Pembina River, and Wolf Creek are being made early.

PEMEX—Plans to start June 1956, on 22-in. line between Reynosa and Monterrey.

Saskatchewan Power Corp.—Fulton Banister, Ltd., has 249 miles in Saskatchewan, to compete September 1, 1956, Jerry Nash, general superintendent; 120 miles of 12-in. from Success to Moose Jaw, to start July 15, office at Swift Current; 53 miles of 6-in. from Biggar to North Battleford and 34 miles of 8-in. from Dana to Humboldt, office at Biggar; started May 15 on 17 miles of 10-in., 4 miles of 6-in., and 21 miles of 4-in. Hoosier extension and gathering lines from Brock field to Eston Transmission lines, office at Kindersley.

South Alberta Pipe Line, Ltd.—Filed permit for 150 miles of 8-in. from Etzikom field to serve a nitrochemical plant to be built near Medicine Hat, Alta.

Dutton-Williams Brothers, Ltd., has 45 miles of 10-in. between Etzikom and Medicine Hat, to complete July 1956, P. D. Campbell, superintendent, office at Medicine Hat.

• **Technical Office of Hydrocarbon, Ministry of Mines and Petroleum, Government of Venezuela.**—Proposes a 321-km., 26-in. line from Anaco to La Mariposa near Caracas.

• **Trans-Canada Pipe Lines, Ltd.**—Time limit to complete financing a 2,250-mile line from Alberta to Toronto and Montreal, is extended to November 1, 1956. New deadline for exporting gas from Alberta is December 31, 1957. Ontario government will help finance line through its province. Tennessee Gas Transmission Co. has proposed a line to take the gas at Emerson, Man. (See Midwestern Gas Transmission Co).

Westcoast Transmission Co., Ltd.—Has let 650 miles of 30-in. from Peace River area, Canada, to Sumas, Wash. Dutton-Williams Brothers, Ltd., has 120 miles of 30-in. from Taylor, B. C., to Azouzetta Lake, to be completed September 1957, O. Graves, spread man, office at Dawson Creek, B. C. Mannix, Ltd., has 110 miles of 30-in. between Huntingdon and Merritt, Fred Byers, superintendent, office at Chilliwack. Canadian Bechtel, Ltd., and R. A. Conyes Construction Co. have remainder, to be completed September 1957.

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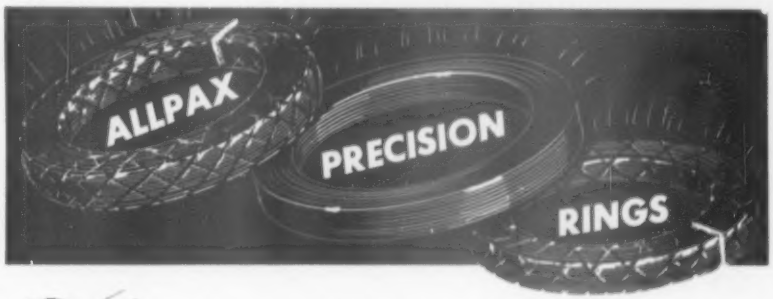

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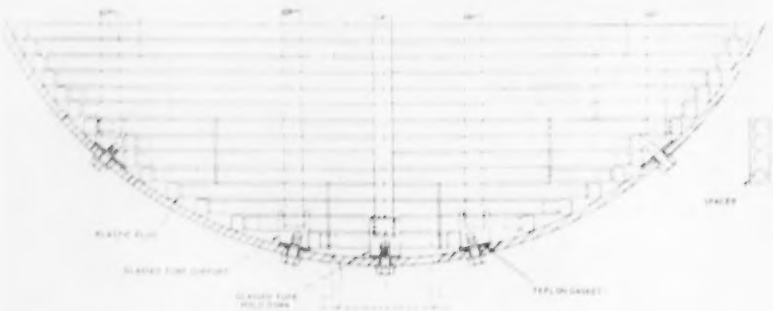
OF NEW EQUIPMENT AND LITERATURE

by Dan B. Miller



Bubble Tray Made of Glassed Steel

Special construction of a new Turbogrid tray has made all of the processing advantages of corrosion-resistant glassed steel available for use in tray-type columns. Until now, use of unique properties of relatively low-cost glassed steel, such as resistance to corrosion at high temperatures and pressures, lack of product adherence, noncontamination and absence of catalytic effects, was restricted because of the problem of supporting a glass tray in an all glassed tower.

Trays are supported inside a glass-lined column by bolting glassed Inconel cups to the column sidewalls. Teflon sheathed gaskets are used for sealing. These cups hold four extra-heavy pyrex tray-support tubes, each encased in a Teflon or polyethylene shield to prevent wear of glass against glass. Small pyrex tubes are laid across the supporting members. These tubes are held in position by Teflon or polyethylene spacers and by another extra-heavy, sheathed pyrex tube laying across them. Tray assemblies usually are inserted in the columns with their tubes at a 90° angle to each other. The round pyrex bars provide a maximum exposure of gases to liquids.

Turbogrid may be installed in new or existing equipment, with a diameter of 18 in. or larger. Liquid flow is evenly distributed over the entire tower diameter. Slot widths may be varied over wide limits to meet varying loads, viscosities, and fouling conditions. Maintenance time has been found to be from 20 to 60 per cent less than requirements for conventional trays. **For more information write or call: The Pfaudler Co., 1011 West Avenue, Rochester, N. Y.**

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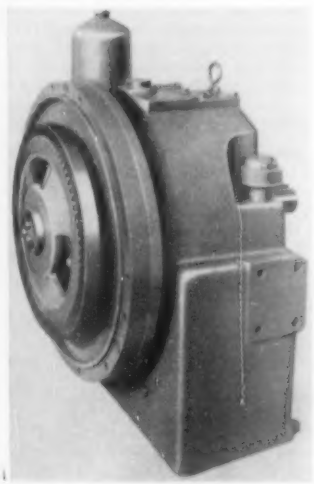

Torque Converters for Engines of 30 to 198 Hp.

A new line of single-stage torque converters has been designed for engines producing from 30 hp. at 1,150 r.p.m. and 198 hp. at 2,400 r.p.m. Specific torque ratings are 165, 200, 240, 285, and 330 ft.-lb., depending upon the impeller blading selected by the user.

The new 1500 Series features unloading of the engine through an exclusive blade design wherein the tur-

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COMPANY _____

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DATE _____

NAME OF CUSTOMER _____

GOODALL RUBBER COMPANY
Incorporated

Certificate No. 2726

Supply Company _____

Point of Sale _____

UNDER Contract Number _____

ROTARY HOSE SERVICE CERTIFICATE

THIS IS TO CERTIFY that the undersigned Supply Company has this day sold and delivered to the Customer named above one Goodall Rubber Company Rotary Hose described as follows:

Serial Number *Size* *Length* *Goodall Specification Number*

and this certificate is issued specifically for the purpose of bringing the said hose within the provisions of the above numbered contract to the above named Customer, and this certificate shall be valid and effective when executed by an officer of said Goodall Rubber Company.

The Goodall Rubber Company hereby unconditionally guarantees Goodall Rubber Co. Rotary Hose against failure due to any defect in workmanship and/or material for the period of one year from date of purchase. If at any time during the 12-month period from date of purchase, such Rotary Drilling Hose as identified by the Service Certificate should meet with accident under normal operating conditions, the Goodall Rubber Company agrees to:

A. Repair such hose without charge to the customer, other than transportation charges to and from the plant designated by the Company, provided in the opinion of the Company it can be made suitable for further use as Rotary Drilling Hose.

B. Convert any such Rotary Hose damaged by accident to such an extent that it cannot reasonably be made useable thereafter as Rotary Hose into as many vibrator hoses as possible, free of charge to the customer except for necessary additional couplings and freight to and from the specified plant.

WITNESS our signature at _____ on the _____ day of _____, 195__.

Accepted and Validated:
GOODALL RUBBER COMPANY

By _____
Title

_____
SUPPLY COMPANY

By _____
Title

Only Goodall offers this guarantee

The Goodall Guarantee shown above is one example of the Goodall way of showing their appreciation to the Drilling Industry. Goodall's success is due to the acceptance of their rotary hose by users all over the world. In order to keep their position at the top Goodall will continue to offer the finest product of its kind made—the Goodall Rotary Hose with the Barney Coupling—at competitive prices.

Goodall stays at the top because they have always pioneered a better product. Some examples are: the first high pressure rotary hose—the Barney Coupling—the Goodall repair service—the built-in safety clamp.

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TRENTON, N. J.

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GOODALL RUBBER COMPANY: New York, Philadelphia, Pittsburgh, Chicago, Denver, St. Paul, Detroit.
EXPORT: Goodall Rubber Company, Trenton, N. J.
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bine develops a counterhead which stops fluid circulation at high speed ratios. This not only simplifies construction by eliminating commonly used free-wheeled stators but also eliminates possible field failures.

The impellers having different bladings, both number of blades and pitch, are interchangeable. Thus, the converter's torque capacities can be matched as accurately as possible to engines of various horsepower outputs and speeds, within rated limits, without requiring changes in the converter housing or other components. **For more information write or call: Twin Disc Clutch Co., Hydraulic Division, Rockford, Ill.**

●

Controller Makes Well Pumping Fully Automatic

A new controller design brings full automation to oil-well pumping. The supertimer, heart of the new controller, performs two major functions in a single unit. First, it programs the pumping operations in 15-minute periods (minutes per hour, hours per day, and days of operation per week). Secondly, it provides 73 accurately controlled restarting intervals in 2½-second increments from 0 seconds to as much time delay as 3 minutes. Simultaneous restarting of a number of pumps on the same power line can thus be avoided. The supertimer permits precise, independent scheduling of pump operations to obtain the best possible electrical and mechanical advantages.

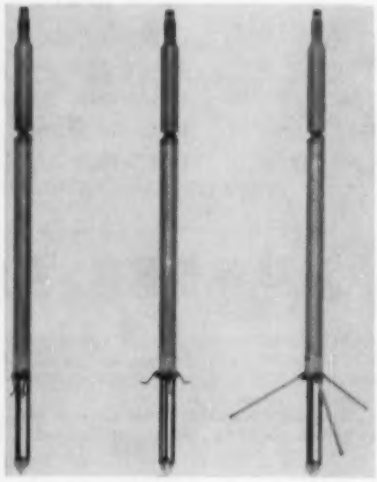
This oil-well-pump control makes coincidental restarts following service interruptions impossible. It provides precise sequence restarting, adjustable restarting periods, delay timing, manual or automatic restarting features. These, plus a full panel of motor-control components, newly designed lightning arresters, a new fuse-block assembly, positive-action low-voltage release, three-phase overload protection, and many more new developments designed for easier installation, better performance, and lower cost operation. **For more information write or call: Cutler-Hammer, Inc., 567 North Twelfth Street, Milwaukee, Wis.**

●

Downhole Calipers Log Microprofile of Wells

Microprofile caliper logging of oil and gas wells has been made possible by a new type of instrument. Features of the new instrument are continuous precision measurements and provision for recalipering any given section in a well hole without withdrawing it for resetting. Caliper arms can be retracted to permit lowering at any time.

The inner ends of the arms, spaced 120° apart, are arranged to vary a resistor hydraulically in such a way as to be independent of the position of the instrument in the hole and of the angle of extension of the arms. The instrument also has temperature compensation in the electrical system to assure accuracy of measurement. A self-balancing bridge provides for recording a continuous curve of hole diameters. Caliper arms of different length are provided in order to produce micrographic records of diameter measurements in holes with diameters ranging from 3 to 50 in.



The tool has been valuable in locating suitable positions for packer seats when preparing for hydraulic fracturing and for computing the volumes of holes before cementing. It has also been used as an aid in interpreting electrical logs, to locate casing perforations, and to determine whether or not a casing has been ruptured. It can be used to determine the kinds of subsurface formations that are exposed in a well hole. **For more information write or call: Birdwell Surveys, Bradford, Pa.**

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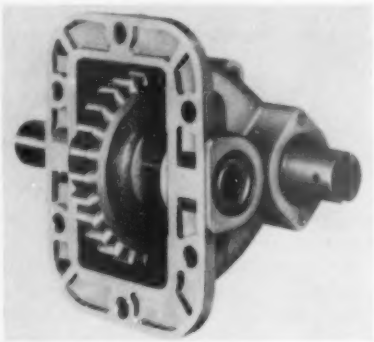


Power Take-Off Series Designed for Medium Duty

A new series of single-speed, single-gear power takeoffs for medium-duty operation is designated Series 22. The new series incorporates qualities of strength, lightness, compactness, dependability, durability, and quiet operation.

Manufactured in nine different models to accommodate all popular transmissions, the entire series offers die-cast aluminum housings for extra lightness and strength; three optional output shaft sizes; hardened shaved gears that mesh with transmission only while takeoff is operating; heavy-duty oil seals, and optional cable or lever control.

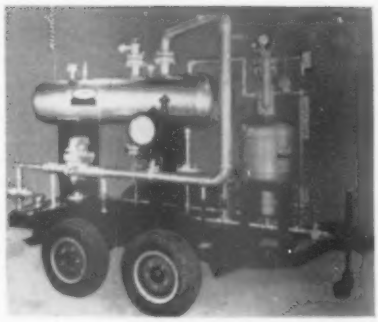
The Series 22 takeoffs can be furnished in any one of four assemblies. Assembly arrangement is indicated on every power take-off nameplate by letter and numeral code. **For more information write or call: Tulsa Winch Division, Vickers, Inc., 815 East First Street, Tulsa, Okla.**

●

Well Tester Rated at 1,200 Working Pressure

This new trailer-mounted well tester, equipped with BV Vol-U-Meter, separates well fluid into oil, gas, and water, meters each and has tie-in lines so that the oil, gas, and water, may be discharged separately or recombined.

The well tester has a working pres-



sure of 1,200 psi. The separating vessel on this unit has a 24-in. o.d. and is 7 ft. long, seam to seam.

The horizontal unit is equipped with a 4-in. gas run and has a maximum gas capacity of 15,000 M.s.c.f.d. It has a maximum oil capacity of 1,200 bbl. per day and a maximum water capacity of 600 bbl. per day.

The Vol-U-Meter discharges 1-bbl. volume per dump and has a rated capacity of 720 bbl. per day. Well testers equipped with Vol-U-Meters are available in other sizes and working pressures. **For more information write or call: Oil Metering & Processing Equipment Corp., 4843 Yale Street, Houston 18, Tex.**

•

Seismic Oscillograph Records in All Techniques

An all-purpose seismic recording oscillograph is designed to operate with all seismic recording techniques. For high, conventional, or low-frequency seismic recording, or use with magnetic recorder, the RS-8U camera has complete operational latitude.

Paper-speed changes for the respective seismic techniques are made with a flip of a control panel switch: very low frequency refraction, 6.6 in. per second; conventional reflection, 13 in. per second; and high resolution reflection, 32.4 in. per second. Paper speeds may be varied ±50 per cent from these speeds by resetting governor. If desired, paper speed can be switched during a record, with the change effected in 0.02 second. Paper speed is maintained to less than 1 per cent deviation.

Light intensity changes automatically with each paper-speed position. Further, rheostat adjustment of both timing light and galvanometer light is provided so that the user may set intensities as desired.

The camera sets atop a stainless-steel developing unit. Paper roll is loaded through the developing unit, eliminating need for any darkroom. It uses either 6 or 8-in. paper in 200-ft. rolls, with 1⅛-in. core, emulsion side in. The entire camera unit is compact, measuring 30 in. high by 12.8 in. wide, and has an over-all weight of 61 lb. **For more information write or call: Houston Technical Laboratories, 2424 Branard Street, Houston 6, Tex.**

•

Helicopter All-Metal for Low Upkeep

The CH-1A is an all-metal, four-place helicopter with side-by-side seating fore and aft. Powered by a supercharged FSO-470-A Continental engine, delivering a net of 260 hp. to the transmission, the CH-1A employs a single lifting rotor and a single antitorque tail rotor. Both fuselage and rotor blades are metal, combining high utility with minimum upkeep.

The engine has been mounted in the fuselage nose for easy installation and servicing, in addition to providing added cargo and passenger space in the fuselage around the main rotor shaft. Smooth control operation is achieved through a simple and totally enclosed rotating-control assembly and the rotor head.

The combination of design and engine provides the same horsepower at 10,000 ft. as at sea level, while the horsepower output raises a maximum gross of 3,000 lb. from sea level to 10,000 ft. in less than 12 minutes.

Carrying a useful load of 1,000 lb., this craft is certified for cruising speeds of 100 to 120 m.p.h. **For more information write or call: Cessna Aircraft Co., R.F.D. 5, Wichita, Kans.**

•

Moisture Barrier Included With Aluminum Jacketing

A new deep-corrugated aluminum jacketing for tanks, towers, and vessels makes it possible to do an all-aluminum jacketing job on any installation. Appearance is improved, and installation costs are cut because of lower first cost and ease of cutting and handling. This aluminum jacketing may be attached with aluminum strapping and seals, or with aluminum sheet-metal screws.

This deep-corrugated jacketing is available with 1¼ or 2½-in. corrugations. Rigidity is increased by crosscrimping the aluminum before adding the deep corrugations. Crosscrimping adds up to 97 per cent greater strength over plain corrugated aluminum.

A new factory-applied moisture barrier, added to the corrugated jacketing, has been developed to completely eliminate corrosion of the jacketing from within, providing a virtually permanent jacketing job. **For more information write or call: Childers Manufacturing Co., Jacketing Sales Division, 3620 West Eleventh Street, Houston, Tex.**

OIL AND GAS JOURNAL

Showcase

- BULLETINS
- CATALOGS
- BROCHURES

Bottom-Hole Chemical Injector Valves. A new four-page, comprehensive folder contains a number of cutaway drawings showing Macco-Otis assemblies, as well as a description of the method of operation, advantages, and installation. **For more information write or call: Macco Oil Tool Co., Inc., 1521 Prince, P. O. Box 7288, Houston 8, Tex.**

●

Oil Refinery, Chemical, and Industrial Engineering, a 56-page book, is the photographic account of men and facilities of this British process-plant engineering firm. It pictures the company's activities in the world-wide business of refinery and chemical-plant fabrication and construction. Factories owned by the group prefabricate pipework and other high-pressure equipment. **For more information write or call: Matthew Hall & Co., Ltd., Dorset Square, London, N.W.1., England.**

●

Lummus Standard Heat Exchangers for Process Industries. Bulletin M-306, an 18-page brochure, includes: a description of the design, specifications, and construction details of these standard units; tables of effective surface area available in the various units; tables of over-all dimensions; and thermal-design data, with tables of film coefficients, pressure drops, fouling factors, and tube characteristics necessary to solve basic equations. **For more information write or call: The Lummus Co., Heat Exchanger Division, 385 Madison Avenue, New York 17, N. Y.**

●

High-Pressure Apparatus, a 52-page catalog, describes, in detail, such standard pressure equipment as high-pressure reaction bombs, vertical and horizontal autoclaves for both medium and high pressures, rotating autoclaves, and catalytical contact apparatus with saturator and separator. **For more information write or call: Chemtech Products Corp., 276 Forest Avenue, Glen Ridge, N. J.**

●

VCP High-Speed Vertical Pump, a six-page foldout, illustrates the application of this bottom-dismantling pump in pipeline booster stations and in refineries throughout the country. Annotated diagrams are used to feature new design principles, and a sectional line drawing depicts the pump's operation. **For more information write or call: Bingham Pump Co., 2800 Northwest Front Avenue, Portland 10, Ore.**

●

Electrically Heated Gages and Valves. Data Unit 237 supplement gives details and illustrates a new line of electrically heated gages and valves. These units have application where accurate gaging requires heating but where no steam is available. They are also suitable for installations where close control of temperature is necessary. **For more information write or call: Jerguson Gage & Valve Co., 80 Fellsway, Somerville 45, Mass.**

●

Twin Disc Power Takeoffs. The new and comprehensive Bulletin 308 on a complete line of friction power takeoffs provides horsepower and torque capacities, side-pull limitations, and dimensions. Included is the latest information on SP-type power takeoffs de-

Don't let vapor losses (or other thieves) steal you blind.

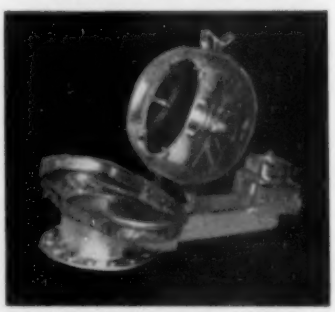
1. Corrosion of tanks. Reduced when correct pressure setting is maintained on all tanks in storage battery, and oxygen is excluded.
2. Gravity drop (premium of 2c per barrel) can be stopped. Many users of vapor control system have reported gravity increases after installation.
3. Volume losses (2½% per degree gravity drop). Very substantial savings have been reported.
4. Lifting costs. These costs can be cut, because with the gravity and volume losses stopped, every barrel produced is saleable.

The elimination of any one of these thieves will more than pay for the installation of an Enardo vapor control system.

The Enardo 770 "By-Pass" thief hatch valve shuts off from the vent line for vapor control. When the hatch is open the "By-Pass" controls the opening into the vent line, sealing off the rest of the tanks in the battery. This automatically holds the correct pressure settings and excludes oxygen. Holding the pressure in all tanks prevents large gravity and volume losses during normal working conditions. The 770 Series hatches feature "bottle-tight" seals and De-icer action gaskets.

Call, write or wire Enardo for additional information.

770 VAPO-GARD THIEF HATCH VALVE



770-BP VAPO-GARD THIEF HATCH VALVE

ENARDO manufacturing company

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signed for high-speed, high-output, industrial engines and ranging from 95 to 602 hp. in capacity. **For more information write or call: Twin Disc Clutch Co., Racine, Wis.**

●

Weldirectory for Mild Steel and Low-Alloy High-Tensile Steels includes the newest iron powder and other electrodes. Bulletin SB-1351 provides a description of each electrode, its physical properties and chemical composition, recommended welding procedures, an operator's reference table, and a list of typical applications for each electrode. **For more information write or call: The Lincoln Electric Co., Cleveland 17, Ohio.**

●

Surface Coatings for Off-Shore Structures. This 22-page, paper-backed book covers problems in off-shore coating systems, work done in the past, and the development of vinyl mastic as a protective coating. The evolution of the vinyl mastic sandwich system of coating is given along with a discussion of other coating methods. Specifications for coating drilling platforms and other marine structures are discussed and recommendations for surface preparation, application, and other problems are given. **For more information write or call: Products Research Service, Inc., P. O. Box 6116, New Orleans 14, La.**

●

Librascope Flow Computer, a four-page, two-color folder, tells of a newly developed instrument that simplifies computations in orifice measurement of fluids. The folder gives specifications and explains how the computer operates and how it is read. The computer is also available as a computing flow meter. **For more information write or call: Librascope, Inc., 808 Western Avenue, Glendale, Calif.**

●

Subsurface Washer for Demineralizers, Zeolite Softeners, and Filters. Technical Reprint T-139 presents the causes of fouling and the problems encountered with actual installations in a variety of industries. The steps leading to the development of the subsurface washer are presented and a cutaway drawing showing this unit is included. Other descriptive material includes flow sheets and a diagrammatic sketch of pilot-unit observations. **For more information write or call: Graver Water Conditioning Co., 216 West Fourteenth Street, New York 11, N. Y.**

●

Bronze Globe-Valve Line. Circular 605, a detailed, three-color leaflet, describes the Fig. LQ600-200 bronze globe valve. The LQ600 valve is available in two complete series for a wider range of pressure applications. Both lines are made in eight different sizes, from ¼ through 2-in. diameters. In 5 years of actual service in the field, the patented Brinalloy seats and disks used in the LQ600 have required no replacement, repair, or maintenance. **For more information write or call: Lunkenheimer Co., Box 360, Cincinnati 14, Ohio.**

●

Chromalox Hi-Temp Thermwire. A new electric heating cable, Chromalox silicone Thermwire, utilizes the amazing heat-resistant characteristic of silicone rubber to permit continued temperatures of 275° F. This development provides a convenient and accurate method of applying or maintaining heat in pipes or irregular objects where consistent high temperatures are required for controlling viscosity, chemical action, and volatility in fluids. **For more information write or call: Edwin L. Wiegand Co., 7500 Thomas Boulevard, Pittsburgh 8, Pa.**

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Heavy-duty ball bearing construction, strong suspension extensions, finger-tip drawer control.

Two separate follow blocks in each drawer of all-steel Model E-24 give actual 8-drawer efficiency . . . and each will easily handle 500 full-size standard electric well logs by using KRAFTBILT folders or filing envelopes. Logs file and transfer without refolding.

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KRAFTBILT folders, filing envelopes, pressboard guides, metal guide tabs engineered to fit Model E-24.

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EQUIPMENT MEN . . . in the News

Opening Planned for Bank Of the Southwest Building

Formal opening plans have been made for the Bank of the Southwest building to be held June 14-17. A general committee heads the dedication network, composed of the bank's top officers: Chairman of the Board Col. W. B. Bates; Vice Chairman of the Board L. R. Bryan, Jr.; and C. M. Malone, and President A. G. McNeese, Jr.

General coordinator for all events is Vice President W. B. Black, Jr., manager of the business-development department. There are 26 separate committees, which include all of the bank's officers and many other employes.

On June 14, there will be open house at 4 p.m. for employes and their families. At 6 p.m. there will be a reception for the press at the Houston Club and a conducted tour through the new building.

June 16 will be the day of the formal dedication ceremonies, scheduled for a 30-minute period starting at 2:30 p.m. The press and special guests will be included in the invitations to the dedication ceremonies.

One feature of the event will be an international exhibit displaying products of the 29 foreign countries represented in Houston by consulates.

Warren Manages New United Supply Store, Harvey, La.

United Supply Co. recently opened a new store in Harvey with Forrest Warren as store manager, according to Brooks Gutelius, Jr., president of United Supply. The store will be operated under the supervision of Ken Murphy, United Supply's representative in New Orleans. Gulf Coast operations are under the direction of C. C. King, division manager with headquarters in Houston.

Gutelius also announced that H. C. Thornton has been appointed manager of United's New Iberia, La., store. Thornton transferred from Great Bend, Kans.

Warren transferred from the managership of the New Iberia store. He has spent several years in South and West Texas.

Barton Instrument Begins New Plant at Monterey Park

Shown at ground-breaking ceremonies at Barton Instrument Corp.'s proposed new 30,000-sq.-ft. plant are Ransom W. Chase, secretary; Barton Jones, president, both of Barton Instrument; Bud Oltmans, contractor; Alvin A. Thompson, sales manager; and Claude B. Nolte, vice president, both of Barton Instrument. The new $200,000 plant, to be constructed in Monterey Park, Calif., is scheduled for completion in midsummer. It will be located on a 5½-acre site and, in addition to the plant, will provide 53,000 sq. ft. of paving. Barton Instrument manufactures instruments for the petroleum and petrochemical industries.

Midwestern Engine Elects Winkler as Sales V. P.

W. F. WINKLER

The election of William F. Winkler as a vice president in charge of sales of Midwestern Engine & Equipment Co., Inc., of Tulsa, has been announced by O. E. Murrey, president, and A. H. Bost, executive vice president of the pipeline and construction-equipment distributor.

The appointment of Robert Karlovich to the position of secretary-treasurer of the corporation has also been announced.

Winkler, who has been sales manager for Midwestern for the past 3 years, was formerly sales promotion manager for Oliver Corp. of Chicago. Karlovich has been with Midwestern 4 years and previously served as Midwestern's assistant secretary-treasurer.

Midwestern Pipe Line Products Appoints Maddox

M. E. Maddox has been appointed district sales representative for Midwestern Pipe Line Products Co. of Tulsa. He will headquarter in Tulsa and will cover Nebraska, Kansas, Missouri, Arkansas, eastern Oklahoma, Fort Worth, and Dallas. Before joining Midwestern, Maddox was with Pipelife Corp. as sales manager.

Enz, Graves Are Magcobar Management Appointees

Floyd A. Enz has been named vice president and secretary-treasurer of Magnet Cove Barium Corp., according to Willard M. Johnson, president of the Houston drilling-mud company. James B. Graves has been appointed as controller of Magcobar to succeed Enz.

FLOYD A. ENZ

J. B. GRAVES

Following 15 years with the building-products industry, Enz joined Magcobar in 1945. After working a year at Magcobar's Malvern, Ark., barite plant, he was transferred to Houston. In 1946 he was named controller.

Graves became a staff accountant with Magcobar in 1951. In 1954 he was named manager of the accounting division.

Fluor Names Advertising, Public Relations Heads

William R. Walker, former public-relations representative, has been named public-relations supervisor of The Fluor Corp., Ltd., Los Angeles; Walter E. Terry was appointed supervisor of advertising; Robert L. Wheeler became supervisor of employe relations; and J. D. DeMarais will become supervisor of employe relations at Fluor's Mid-Continent division, Houston, August 1. These appointments were announced by J. F. Gardner, department director.

Supervision of advertising for Fluor Products Co., Whittier, remains under E. B. Dewey.

District Mgr. and Field Salesmen Named By Mission

HIGGINBOTHAM

A. E. Higginbotham has been promoted to the newly created position of sales manager for the Southeast district of Mission Manufacturing Co.; Paul Chisholm has been named field salesman in the Great Bend, Kans., area; and Lloyd W. Bahr has been named field salesman in the Hobbs, N. M., district, according to Ted Fullinwider, domestic oil-field sales manager of Mission.

Higginbotham, who will be located in New Orleans, has been with Mission as a field salesman since 1946, during which time he has been assigned to the territory including southern Louisiana and Mississippi. Chisholm has been previously employed by Jones & Laughlin Steel Corp., where he was store manager. He succeeds John Brown who has been promoted to the position of city sales representative in Tulsa. Bahr joined Mission in 1945. His experience includes work in several manufacturing departments and sales office work. Formerly he was assistant chief clerk in the sales department.

Walker Well Heads Opens Extension at Sales Meet

At its annual sales meeting held in Tulsa on May 18, Walker Well Heads, Inc., opened 4,800 sq. ft. of additional office and plant space, giving the firm a total of 11,200 sq. ft. of plant space.

Sales organization shown at the sales meeting were: front row, Joe Becker, representative; Jack Becker, vice president; Trey Ealey, secretary and treasurer; Clinton Walker, president; Emilio Viana, Latin American sales and service representative; Gene Owen, orders and shipping; Jack Salles, city sales representative, all of Tulsa.

In the back row are: Steve Stephens, representative, Shreveport; Dick Swindler, representative, Odessa; Cecil Dobbs, representative, Abilene; Jerry Carter, bookkeeper, Tulsa; A. D. Eastham, representative, Borger, Tex.; Joe Perry, representative, Salem, Ill.; and Joe Robinson, representative, Great Bend, Kans. Not shown in the picture but at the meeting were Blondy Price, representative, Wichita Falls, Tex.; Red Martin, representative, Corpus Christi; and Jerry Walsh, representative, Borger.

McLaughlin Heads Welex Jet's Falfurrias Office

Gordon McLaughlin has been appointed district manager of Welex Jet Services, Inc.'s district office at Falfurrias, Tex.

McLaughlin, a veteran of 25 years in oil-well-service work, has been with Welex 7 years. Previously, Gordon had worked as a roustabout, a pumper, and a service-unit operator with other companies, before working in various service and sales positions with Welex.

Western Begins Series of Gammatron Seminars

A Gammatron seminar on the use of radioactivity well logs was conducted by The Western Co. at Lake Murray Lodge, Ardmore, Okla., recently. Over 100 production superintendents, geologists, engineers, and other production personnel from both major and independent companies attended two evening sessions.

The seminar was conducted by Raymond G. Loper, special sales representative from Western's general offices at Midland, Tex. W. W. Wilson, Western's regional sales manager at Oklahoma City, was chairman of the seminar.

M. E. Woodward, regional sales manager at Midland, announced that a similar seminar would be held at Roswell, N. M. The Western Co. is planning a continuing series of such schools with increasing emphasis on the technology and use of radioactivity well logs.

Motorola Names Olson Microwave Specialist

Austin E. Olson has been named industrial communications engineer for Motorola Communications & Electronics, Inc. in California, Arizona, and Nevada. He will headquarter at San Mateo, Calif.

Olson will be responsible for sales activities of microwave and industrial-communications products throughout the area, including supervisory control equipment and carrier systems. His appointment was announced by Leonard Walker, sales manager for microwave and industrial products.

A sales engineer for Motorola microwave products since 1950, Olson previously served in engineering capacities for Admiral Corp., Hazeltine Laboratories, and Magnecord, Inc.

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helps keep mud fluid in hot holes!

The photo above shows the fluidity of a DRISCOSE emulsion mud aged at 325°F. The inset shows the cement-like characteristics of a high lime content mud aged under the same conditions.

The deeper you drill the more headaches you come up with . . . usually! But DRISCOSE gives you a high-stability mud. Low pH, low solid, DRISCOSE emulsion muds have been a tremendous aid in solving gelation problems in deep, high temperature wells.

Drilling and completion work with a low solid DRISCOSE emulsion mud reduces the need for treating chemicals. Some chemicals alter the resistivity of mud and flatten the spontaneous potential curves. DRISCOSE emulsion mud gives a more accurate electric log due to the reduction of these chemicals.

DRISCOSE provides excellent water loss control and greatly improves the weight-suspending properties of the mud. It is easily handled; soluble in hot or cold water. Order DRISCOSE from your regular mud dealer. Expert technical assistance is available on your special mud problems. Write for full information on DRISCOSE.

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No Cretaceous Oil in Williston?

by Frank J. Gardner

IT'S been said that Canada's giant Pembina field wouldn't be with us today if it hadn't been for an alert well sitter who tasted oil in the mud and insisted on a test of the Cardium sand.

It's true that the pay zone could easily have been overlooked. And it's only because of such alertness that it wasn't. For many Cretaceous oil pools have an obscurity complex, and to find them, you've got to ferret them out with every method in the book.

All this leads up to a question: Why is it that Williston basin operators in the U. S. have scored zero on Cretaceous oil pools? The Canadians have found quite a few (see map). Are they more diligent in the search, more alert in their drilling, or is it just geologic caprice?

A sand-patch play . . . The drilling spree that has taken place in the Denver-Julesburg basin the past few years was aimed at an erratic Dakota sand trend dependent more on stratigraphic kinks than on structure. The same thing happened in Wyoming's Clareton trend. Today, we are witnessing a similar "sand-patch" play developing in the Paradox basin of the Four Corners region. Why, then, should we not expect a similar episode at Williston?

The earliest drilling done in this region was directed to the aquifers of the Dakota-Cretaceous, on the edges of the basin. Many of these water wells reported oil and gas shows, and they actually led to commercial gas fields on the Cedar Creek anticline and Bowdoin dome. In Central South Dakota, dry gas was produced from water wells drilled to the Dakota as early as 1894. Gas has been found in Upper Cretaceous sand in Bottineau and Renville counties North Dakota, at 300 ft. and less.

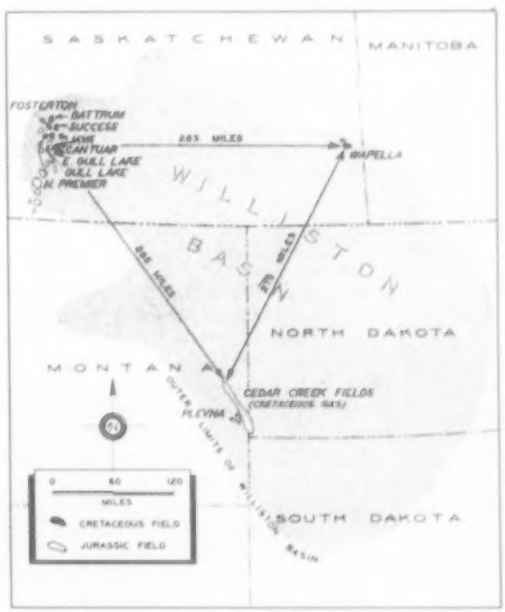
Several shallow gas fields along the axis of the Cedar Creek anticline were finally developed in a series of thin, lenticular, shaly sands on a series of low-relief zones. The first of these, Gas City field, was found in 1915. Other fields were found at Little Beaver, Cabin Creek, and Baker. The productive sands were Judith River at 800 ft. and Eagle at 1,500 ft.—both Upper Cretaceous.

For possible production . . . But success has skipped the Cretaceous of Williston since real development came to the basin in 1951. Even though nearly half the footage drilled in the basin is in Cretaceous rocks, they've received little attention in a search aimed primarily at the Paleozoics. Maybe some potential pay zones are being overlooked. These rocks attain a thickness up to 4,000 ft. in the center of the basin. The basal sandstones are universally present, although erratically developed. Oil staining has been reported in cores of the Muddy sandstone in many spots. The Greenhorn limestone gives off such a terrific gas kick when it's drilled that it has tempted more than one operator to test.

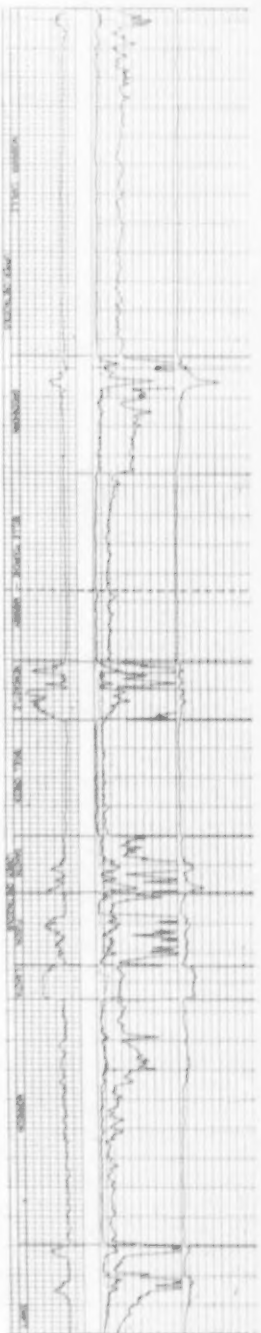
On the east side of the basin, it has been found that the structure on the Dakota top may reflect topography and structure in the Paleozoics. And Dakota structure can be mapped on water-well controls. The Canadians have employed core drilling to a much greater extent than have the American operators. And they have nine Cretaceous pools to their credit.

Calls for concentrated drilling . . . It could well be, then, that a concentrated structure-drilling campaign is the key to success on the east side of Williston, and that Cretaceous luck could lead to Paleozoic luck. But we won't know until hundreds of new wells are drilled east of the Missouri River. A combination of proper sand facies and minimum structure has been the recipe for Cretaceous pools at Denver-Julesburg. The same recipe could apply in Williston.

Have you tasted your mud lately?



WILLISTON BASIN OPERATORS in the U. S. have found no Cretaceous oil fields. Canadian operators have found nine. Type well log at right displays Cretaceous section at Williston (courtesy Schlumberger Well Surveying Corp.)



AFTER 30 YEARS of intense exploration, South Arkansas geologists are still finding new reserves. Fig. 1.

With drilling 145 per cent ahead of 1948 . . .

South Arkansas Sees Rosy Future

by Ernest J. Murdoch

AN encouraging future outlook for South Arkansas is indicated by the greatly accelerated drilling activity of recent years (Table 1). The total number of wells drilled there in 1954 was 74 per cent greater than in 1948. In 1955 more wells were drilled there than in any one year since the Smackover field boom year of 1922. This represents a 145 per cent increase in drilling activity over 1948.

Future exploitation, particularly by the independent operators who are primarily responsible for recent accelerated drilling, should continue at the present pace for at least the next few years. Results should be comparable to the past few years.

South Arkansas, like many of the older producing provinces in the United States, has been explored intensely for the past 30 years or more. No single new discovery has established reserves of major proportions since the discovery of the Midway field in Lafayette County in 1942. The major fields have been discovered long since, and the industry has reached that phase in wildcat exploration wherein the smaller and more obscure areas of possible production are receiving much more consideration.

The following suggestions and predictions, relative to the merits of future exploratory drilling in South Arkansas, are based on a historical and statistical analysis of exploration and development drilling in the area since the first discovery in 1922.

Possibilities for Future "New Field" Discoveries

Smackover lime possibilities (Jurassic age) . . . The Smackover lime is the oldest and deepest-producing reservoir rock in the South Arkansas area. Prolific reserves of major proportions have been established in the Smackover in many fields. They account for almost a fourth of the total recoverable reserves established to date in the area.

The primary objective of seismic exploration for the past 20 years has been new Smackover lime fields. No individual discovery in the Smackover, with reserves of major proportions, has been made since the discovery of Midway field in 1942. Twelve to thirty-one wildcat wells per year have penetrated the Smackover lime during the past 10 years. Several new fields with commercial reserves have been discovered in this period, but they are relatively small in comparison with the Smackover fields discovered from 1936 to 1942. The reserves of these newer, smaller Smackover fields (such as Cairo in Union County, Bear Creek in Union County, and West Midway in Lafayette County) range from 1 to 7 million barrels each.

In view of the extensive seismic activity conducted in the past while searching for new Smackover structures, and the results of wildcat drill-

TABLE 1 — DRILLING ACTIVITY IN ARKANSAS—1948 THROUGH 1955

Year	Wildcat wells	Total wells
1948	85	307
1949	84	342
1950	82	412
1951	90	397
1952	101	402
1953	111	526
1954	89	535
1955	123	754

Author is petroleum geologist, Shreveport, La.

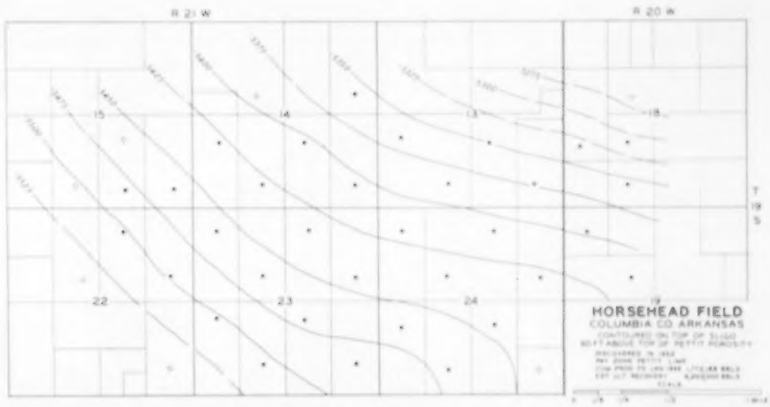
ing for the Smackover objective in the past 10 years, the economics for future Smackover wildcat drilling looks dim. We can conclude only that all of the larger and more obvious, and numerous smaller, Smackover structures have been mapped and drilled. This conclusion, however, should be qualified to this extent: all of the larger and more obvious anticlinal Smackover structures which can be mapped with previously accepted seismic techniques and methods of interpretation probably have been mapped and drilled.

New areas . . . Smackover wildcats are expected to average 15 wells or more per year during the next few years in a valiant effort to find new production in this prolific reservoir. These wells will be drilled on the smaller, undrilled Smackover anomalies. The risk ratio of these wildcat wells, if drilled only on the merits of the older seismic mapping, cannot be anticipated to be more favorable than the statistical average of the past 10 years.

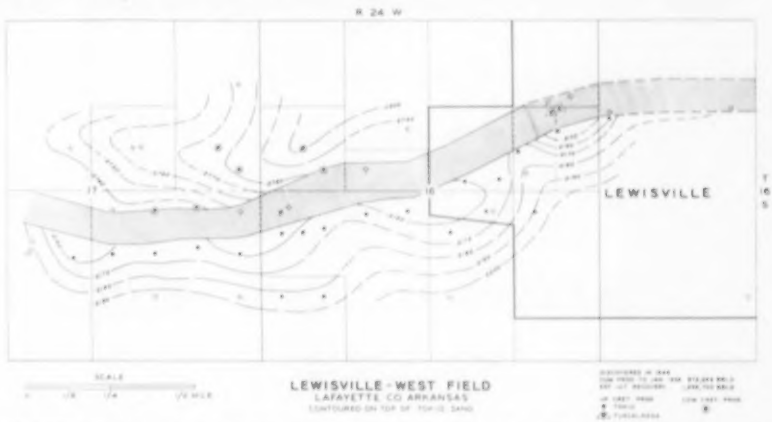
More favorable risk ratios of such future drilling may be anticipated by a very critical and detailed reanalysis of both seismic and subsurface data, supplemented by a certain amount of new seismic control using improved instruments such as the magnetic tape recorder. The reanalysis of the older seismic data, and interpretation of the supplementary control, should be especially critical with respect to structural maps on the Buckner anhydrite, Smackover lime, and both top and base of the salt underlying the Smackover. Isocron maps of the Buckner, Smackover, and salt are considered to be especially critical.

Considerations . . . Smackover possibilities for the future should include at least one additional consideration. Until very recently, all Smackover reserves discovered in South Arkansas have been on anticlinal closures. In 1955 Smackover production was discovered in old faulted Fouke field in Miller County. This is the first Smackover production from a known fault trap in South Arkansas.

Smackover fault traps have been proved productive in North Louisiana for the past several years. While the age of faulting there has resulted in conditions not identical to those of South Arkansas, the future possibilities of Smackover production associated with fault traps in South Arkansas cannot be ignored. The 1955 discovery of Smackover lime production in Limestone County, Texas, along the Mexia fault zone well may be a warning light as to the future possibilities of Smackover fault traps in South Arkansas.



HORSEHEAD FIELD is a stratigraphic trap with production from the Pettit limestone about 60 ft. below the top of the Sligo formation. Fig. 2.



PRODUCTION in the Lewisville area is controlled by faulting. The fault plane dips at an angle of about 45 degrees. Fig. 3.

Cotton Valley formation . . . Future possibilities for discovery of "new area" commercial Cotton Valley production are considered to be more favorable than the indicated Smackover possibilities. Commercial Cotton Valley production has been found on several smaller Smackover structures where the Smackover is either nonproductive or of relatively minor importance. Among these fields are New London, East Schuler, and Catesville—all in Union County. This indicates a definite future for this type of discovery.

The lenticular character of the Cotton Valley sands, particularly in the upper part of the formation, enhances future discovery possibilities in these sands in traps combining both structural and strat-trap characteristics.

Future Possibilities of the Lower Cretaceous

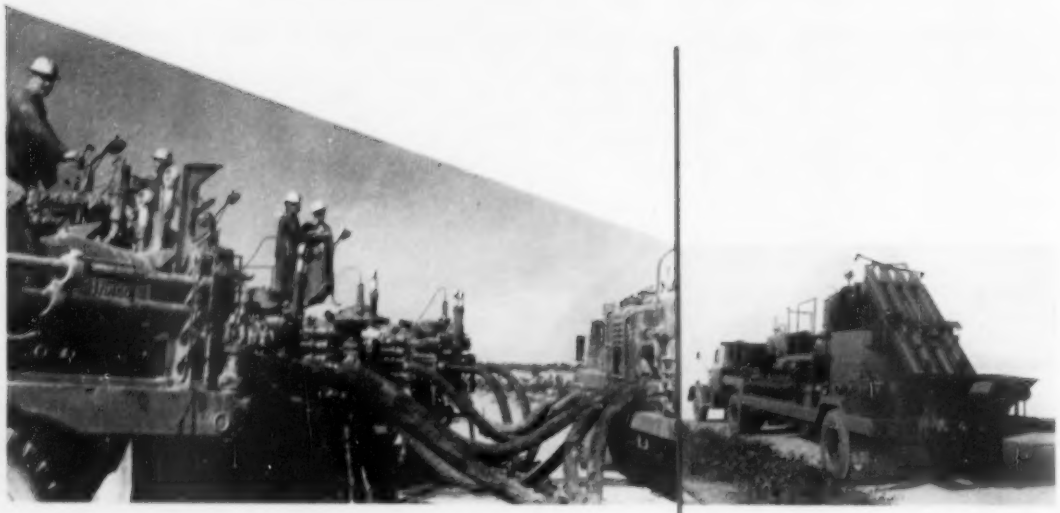
Travis Peak (Hosston) . . . The lenticular character of the Travis Peak sands gives this formation possibilities for future discoveries similar to the upper Cotton Valley sands. Areas of relatively low relief, particularly when situated on the axes of regional noses, have possibilities for traps primarily of the strat type.

The most favorable economics for wildcat drilling for Travis Peak objectives appear, however, to be for those wells searching for fault traps along the known trends of regional faulting.

Glen Rose . . . The future of "new-area" Glen Rose production merits very serious consideration. Various known productive limestone and sandstone horizons in the upper Glen Rose (Mooringsport) and also in the lower Glen Rose (Rodessa) have good possibilities for new-area discoveries in various types of traps.

The purely strat-type possibilities are demonstrated in Horsehead field in Columbia County, discovered in 1952. The oil trap at Horsehead (Fig. 2) is caused by absence of Pettit lime permeability along strike northwest and southeast of the productive area and up-dip northeast of production.

Future chances for new Glen Rose discoveries, in areas where structure is secondary to the primary factors of permeability and porosity in controlling accumulation, is illustrated by Kiblan-



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West Bradley fields in Lafayette County. The discovery of commercial production in this area in the Gloyd lime (Rodessa) in 1953, and later in the Mitchell and Hill zones (Rodessa), has resulted to date in the development of an estimated recoverable reserve of about seven million barrels.

Future Glen Rose new-area discoveries also may be anticipated in fault traps along the known trends of regional faulting.

Paluxy . . . The Paluxy sands are of particular interest in current exploration and development drilling along the fault trends in Miller County, the North Fouke area, and also in recently discovered McKinney-Bayou field, in Miller County. There recent exploitation of the Paluxy sands and various other pay zones has proven to be very attractive and is indicative of the future possibilities for Paluxy fault-trap discoveries.

Upper Cretaceous Possibilities

The most favorable economics for future wildcat drilling for new-area upper Cretaceous oil is believed to be along the known trends of regional faulting. The fault trends in Miller, Lafayette, and Nevada counties, in particular, appear to be favorable (Fig. 3).

The upper Cretaceous sands of the Nacatoch, Buckrange, Blossom, Tokio, and Tuscaloosa (Lewisville) are all potential commercial reservoirs for new fault-trap discoveries. The Tokio and Tuscaloosa sands are of primary interest in the upper Cretaceous in current activity along these trends.

Additional possibilities for new-area upper Cretaceous discoveries should exist in areas of low-relief closure, particularly along the axes of upper Cretaceous regional noses. A critical and detailed review of all seismic and subsurface data in these areas (possibly supplemented by additional seismic data using high-resolution recordings for greater accuracy in the shallow reflections) may result in the discovery of new-area upper Cretaceous production traps of structural closure or in traps with both structural and strat-type characteristics.

Future Possibilities in Older Areas of Production

Exploratory and development drilling in the older areas of production, both within the limits of production and on the flanks of various fields, has added substantial new reserves every year for the past 10 years or more.

The future possibilities for discovery of new oil reserves in the older producing fields are indicated by the following discoveries in recent years:

Smackover field . . . Smackover field, discovered in 1922, is the "granddaddy" of all South Arkansas fields. Estimated ultimate recovery, primarily from the upper Cretaceous sands, is almost half of all reserves established to date in South Arkansas.

In 1953 the first significant Travis Peak (lower Cretaceous) production was established on the east flank of the structure. This reservoir is a strat-trap caused by a shaleout of the producing sand. Estimated recoverable reserves established to date are 3½ million barrels.

In 1955 additional new reserves were added to this old field by the discovery of Cotton Valley and Travis peak production in the Snow Hill area of the field. Development drilling here is still active. To date, 14 flowing wells have been completed, some of which are dual completions.

Schuler-East extension . . . The east extension in 1952 of old Schuler field in Union County (discovered in 1937), is an example of future possibilities for new oil discoveries by extension drilling on the older producing structures. The eastern limits of production were assumed to have been established in 1938, although the most easterly wells on the axis of the structure were completed as producers. The east extension area, contiguous with the older eastern portion of the field and with no dry holes between the old and new production, has established new recoverable reserves for this old producing structure. These reserves total about 3½ million barrels, primarily from Cotton Valley sands.

East El Dorado . . . The discovery of new upper and lower Cretaceous production in 1951 in the Ezzell and Rogers areas of this old Nacatoch-sand field in Union County (discovered in 1922) has added about 4 million barrels of additional reserves. This is another example of the future possibilities of finding new oil reserves by extension drilling in older areas of production.

Falcon field . . . Possible discovery of new oil reserves in the older producing fields within the trends of regional faulting is illustrated by the development history of Falcon field, discovered in 1938 in Nevada and Lafayette counties. The first production in this complexly faulted field was in the Nacatoch sand. In 1947, Tokio production was discovered and roughly 2 million barrels of additional reserves were proved for this reservoir. In 1954 Blossom sand production was discovered, adding an additional reserve of about ½ million barrels.

Development drilling resulting from fracturing . . . One factor responsible for the accelerated rate of drilling in South Arkansas in the past few years is the successful use of formation fracturing in the tight shaly facies of the Nacatoch sand. Some 28 per cent of development drilling in South Arkansas in 1955 was devoted to this type of exploitation, and it will undoubtedly continue at this rate for the next year or two at least.

The Nacatoch sand in such Union County areas as North Lisbon, Sandy Bend, West Urbana, and West Woodley, has long been known to be capable of very low productive potentials ranging from 2 to 5 bbl. per day. The application of formation fracturing in completions in these areas in the past 3 years has made this type of reservoir very attractive to the independent operators.

Production following fracture treatment ranges from 15 to 25 bbl. per day for a few months, but then a steady decline results in a daily average of about 10 bbl. per day at the end of the first year. The shallow depth (roughly 2,300 ft.) and the anticipated long life of this type of production are the primary factors which encourage this type of development drilling.

Conclusion

1. The present rate of drilling in South Arkansas is expected to continue for at least the next few years.

2. Favorable economics is anticipated for exploratory drilling, subject to certain limitations in recognition of historical, statistical, and geological factors.

3. The most favorable areas for wildcat drilling are along the known trends of regional faulting, particularly in Miller, Lafayette, and Nevada counties.

4. Smackover lime fault-trap possibilities may result in revived interest in this formation.

5. South Arkansas strat-trap possibilities for future wildcat drilling, where structure is a secondary factor in oil accumulation, is a challenge to the geologist. This requires thinking more in terms of oil-traps than merely in terms of structure.

6. Development and extension drilling in and on the flanks of presently producing fields will continue to add new and profitable reserves to the South Arkansas area.

Acknowledgment

The author sincerely appreciates the assistance and cooperation given by the staff of the Arkansas Oil and Gas Commission. Appreciation is also extended to numerous associates in the Ark-La-Tex area for suggestions and helpful criticism.

EXPLORATION HIGHLIGHTS

APPALACHIAN

EASTERN KENTUCKY

In Pike County and located on map square 38-409, United Fuel Gas Co. is moving in materials for a wildcat test. Elevation is reported as 872 ft.

An attempted deepening of an old well in Big Sandy gas field has resulted in failure. Kentucky West Virginia Gas Co. drilled from old total depth of 1,802 ft. in the Maxon (Mississippian) sand formation to a new depth mark of 3,578 ft. Hole was bottomed in Devonian shale which yielded only 28,000 cu. ft. of gas daily after shot. Test was 6,142 John Francis et al, located on Brushy Ford in Pike County.

PENNSYLVANIA

In Pine Township, Indiana County, Southwest Pennsylvania, Pittsburgh Plate Glass Co. has announced location for 1 Jesse Ober, wildcat, elevation 1,973 ft., Barnesboro Quadrangle, 4.59 miles south of latitude 40 degrees 40 minutes, 0.80 mile west of longitude 78 degrees 55 minutes.

● In Banks Township, Columbian Carbon Co. 1831 Farmers & Miners Trust Co. fractured the chert and is blowing the oil. The bottom of this formation was at 7,478 ft., and the drilling was shut down at 7,538 ft.

● In Young Township, Manufacturers Light & Heat Co. 4336 Stewart and R. & P. Coal Co. is at 6,000 ft.

● Gaskill Township, Jefferson County, Columbian Carbon Co. 1834 Harriett McClure topped the chert at 7,292 ft., and shut down at 7,300 ft. to run 7-in. casing.

WEST VIRGINIA

Magnolia district, Mingo County, West Virginia, Carnegie Natural Gas Co. 5-1686 U. S. Steel Corp., elevation 1,402 ft., resulted in one of the largest volume gas wells to be completed recently in this area. The initial open flow was 22,427,000 cu. ft. natural, rock pressure 695 psi. The Big lime was topped at 2,624 ft., gas 2,859 to 2,895 ft. Total depth 2,895 ft.

● Licking district, Tucker County, Hope Natural Gas Co. ran the 7-in. casing in 9985 J. H. Ludwick at 3,833 ft., elevation 1,710 ft.

OHIO

A south extension to the new pool south of Cottage Hill in Hopewell Township, Muskingum County, was completed by Central Ohio Oil Co. on 3 Thos. Esselstein, Lot 35. Clinton sand was found at 3,136-73 ft. and gaged 100 bbl. and 225,000 cu. ft. gas after Fracturing.

● Along the north edge of the Perry Township, Coshocton County, pool Preston Oil Co. 5 Ross Wilson, Section 14, gaged 129 bbl. after Fracturing from Clinton at 3,112-60 ft.

● The Natol Corp., which has had considerable success in finding new production, is drilling a wildcat on Ethel Stewart, Section 19, Clark Township, Coshocton County.

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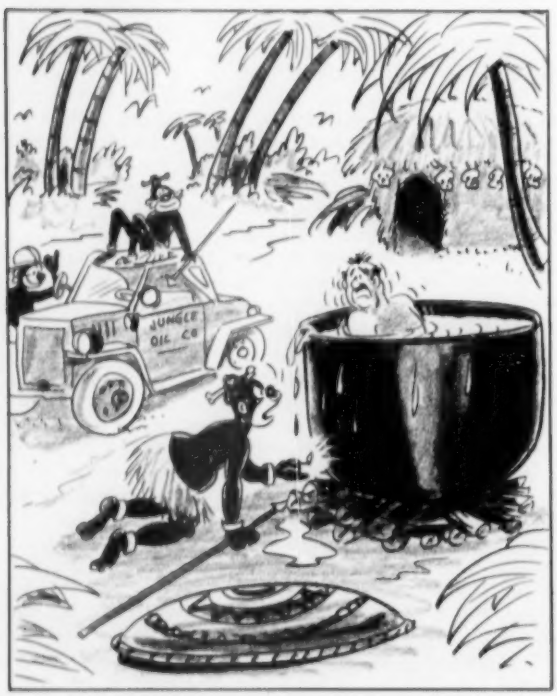

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ARK-LA-TEX

EAST TEXAS

Oil Properties, Inc., Dallas, completed its confirmation well for West Slocum, being a long south offset to the discovery. This was 1 Springman, which made 291.66 bbl. of 44° oil a day from the Woodbine at 5,689-91 ft. The same firm's discovery flowed 338 bbl. of oil a day through ¼-in. choke from pay at 5,740-42 ft.

At this report, South Slocum field, Anderson County, has two wells waiting on potential and 1 drilling. At North Slocum, 1½ miles north of Slocum townsite, one well was drilling. This is J. S. Michael 1 Averitte, a new test in Allen Killough Survey, slated to 6,700 ft. Location is a north offset to the field discovery.

PACIFIC COAST

CALIFORNIA

Strand Field Gets Two More Extensions

Two recent completions in two different zones continued to point up the growing importance of the Strand field in Kern County. Tidewater Oil Co. deepened an old well, E-3-7 Strand-KCL, to 9,603 for a successful basal Stevens completion flowing 659 bbl. daily of 34.7°-gravity crude through a 24/64-in. choke. The producing interval is 9,530-75 ft.

A few hundred feet north of Tidewater's E-3-7 Strand-KCL, Shell Oil Co. tapped the Vedder with the 12,495 ft. 111-7 Shell-TWA-Continental-KCL. This extension was brought in flowing 476 bbl. daily of 38.3°-gravity crude through a 20/64-in. choke. The producing interval is 12,440-52 ft. It is located about ¼ mile east of the Vedder discovery well in the Posuncula area of the field.

Gas Find for Humble

Humble Oil & Refining Co. chalked up a new gas field discovery in the Whiskey Slough area of San Joaquin County with completion of 1 Raggio. This test, located in NE NW 9-1n-5e, produced dry gas at a 5,073 M.c.f. daily rate on a 2-hour test of the interval 5,270-77 ft. It is approximately 3 miles southeast of McDonald Island field and 2 miles northwest of Robert Island field.

Shell Scores at West Newport

Shell Oil Co. proved up production in the West Newport field, Orange County, an additional ½ mile northwest with 1 Karales. This 4,050 ft. test was completed flowing 311 bbl. daily of 22.6°-gravity crude through a 16/64-in. choke from the interval 3,146-3,680 ft. Shell drilled this well on a farmout deal from Federal Oil Co. The well site is located NW NE 19-6s-10w.

Drillpro Extends Jewett Production

Drilling & Production Co. recently extended Jewett zone production in Tejon-Grapevine field, southern Kern County, two locations west of the nearest Jewett producer. The well, 63-32 JV, was completed flowing approximately 600 bbl. daily of 38.4°-gravity crude through an 18/64-in. choke. The perforated interval in the 7,497 ft. test is 7,332-7,452 ft. It is located SW NE 32-11n-19w.

Getty Completes Santa Fe Test

Getty Oil Co. became the latest operator to tap the new Santa Fe deep zone in Santa Fe Springs field, Los Angeles County. Getty completed 52 Hill for 963 bbl. daily of 33°-gravity crude through a 24/64-in. choke. This 9,110-ft. extensoin test is located about 1,500 ft. northwest of General Petroleum Corp.'s pool discovery well. Getty also appeared about ready to complete another good well in the same zone with 33 Nordstrom. This well, which is a redrill of an old well, tested at the rate of 60 bbl. an hour from the interval 8,116-70 ft. It is located about 1,000 ft. west of GP's discovery well. At last count there were 19 rigs drilling on this new deep zone play.

GREAT LAKES

MICHIGAN

The old Muskegon oil pool, one of Michigan's original commercial fields, was stirred and possibly reactivated along its southeast, undeveloped flank as a new producer in that area logged a top Traverse oil pay that flowed at a restricted rate of 20 bbl. of oil an hour on initial tests after acid treatment with 1,000 gal.

This new well, drilled by Albert M. Rosa at the 1 Fagan, SW NW SE 10-10n-16w, Muskegon Township, Muskegon County, was bottomed out 1 ft. in Traverse at 1,657 ft., total depth. Well carried a hole full of oil natural. After acid treatment, various choke arrangements were tested. At 11/64-in. choke setting well flowed an average of 3 to 4 bbl. an hour for 2 days. With opening set at 12/64-in. production totaled about 8 bbl. of oil per hour. No water was in evidence. Well was

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Stone & Webster Securities Corporation — Union Securities Corporation

A. C. Allyn and Company Incorporated — Bear, Stearns & Co.

May 21, 1956.

scheduled to be restricted to about 80 bbl. of oil a day. South 10-acre offset to 2 Fagen, also drilled by Rosa, missed this top Traverse pay and is being produced from a pay logged about 40 ft. in this objective.

HUGOTON EMBAYMENT

NORTHWEST OKLAHOMA

Laverne Area Well Completed As Big Gasser

Cities Service Oil Co. reported open-flow potential at its 1 McClung-A in NW NW SE 11-26n-25w, Northeast Laverne field, Harper County.

The well flowed 100,000 M.c.f. of gas per day from the lower Tonkawa sands at 5,455-70 ft. From the Chester-Mississippian the well made 10,500 M.c.f. of gas per day on open flow from perforations at 6,945-66 ft.

Hoover Show Reported At Stockholm Well

Oil Capitol Corp. tested gas shows in the Hoover-Pennsylvanian at the 1 Zoldoske, C NE SE 14-26n-24w, on the east side of Southwest Stockholm field, Harper County.

A 2-hour drill-stem test at 4,300-39 ft. made gas in 35 minutes, increasing to 60 M.c.f. per day in 45 minutes to 116 M.c.f. in 75 minutes. Recovery was 50 ft. of gas-cut mud.

East Laverne . . . Sun Oil Co. 1 Carlisle, C SW NE 25-26n-25w, flowed 3,500 M.c.f. of gas per day on 34/64-in. choke from perforations in the Hoover sand at 4,152-4,212 ft. On 26/64-in. choke the well flowed 2,700 M.c.f. per day. Morrow sand perforations at 7,070-80 ft. will be treated.

OKLAHOMA PANHANDLE

Douglas Gas Discovery Completed in Beaver

Beaver County has a new Douglas-Pennsylvanian Virgil gas pool-opener. The discovery well is Harper Oil Co. 1 Bass in C SE SE 14-3n-24eCM, 5 miles southwest of the town of Riverside.

The well flowed 12,468 M.c.f. of gas daily from perforations at 5,372-88 ft.

Northwest Elmwood . . . Union Oil Co. completed the 1 Yates Unit, the second well in Northwest Elmwood field, Beaver County.

This oil strike, located in C NW SE 10-2n-23eCM, flowed 275 bbl. of oil per day on 18/64-in. choke from perforations in the Morrow sand at 6,983-7,054 ft. This opens oil production in the gas field. The discovery well here was the 1 Parker, a 1955 strike. Flow was 28,250 M.c.f. of gas per day from the Morrow sand at 7,096-110 ft.

TEXAS PANHANDLE

Atoka Discovery Completed At Ochiltree County Site

Shamrock Oil & Gas Co. completed its 1 J. E. Williams et ux in west-central Ochiltree County as an Atoka-basal Pennsylvanian discovery. Location is 5½ miles southwest of Farnsworth town.

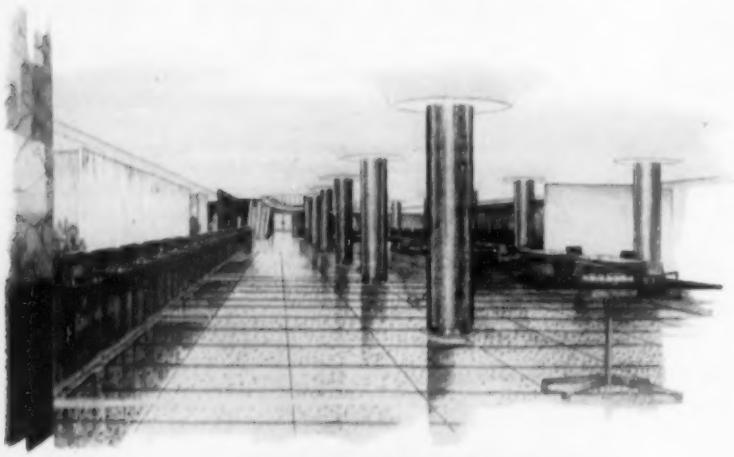
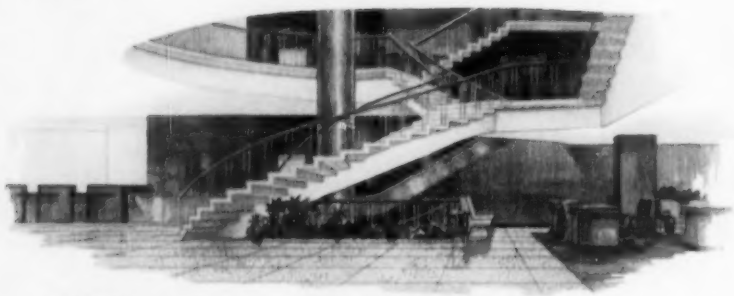
The well flowed 119 bbl. of oil per day on ¼-in. choke from perforations at 7,803-10 ft. in the Atoka.

SOUTH LOUISIANA

West Bay Discovery Shut In for Tests

Union Producing Co. tested oil from two pay zones at the 1 Tambour Corp. et al. in the West Bay area of Plaquemines Parish, 29-22s-31e.

The well flowed 70 bbl. of oil per day and 860 M.c.f. of gas on ⅛-in. choke from 9,342-44 ft. From 10,454-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57 ft. the discovery flowed at the rate of 353 bbl. of oil per day. Tests are due in another zone at 10,651-10,666 ft. before final gage is made.

Completion Reported at Rayne Well in Acadia

A new gas-distillate well was completed at Rayne in Acadia Parish, 12-9s-2e. The well is Continental Oil Co. 1 Homseekers sand Unit 5. The well flowed at the rate of 238 bbl. of distillate and 1,417 M.c.f. of gas per day on 12/64-in. choke from perforations in the Homeseeker sand at 12,680-12,700 and 12,718-34 ft.

Also at Rayne, the 1 Edward Arceneaux, 12-9s-2e, was completed flowing 273 bbl. of distillate and 4,020 M.c.f. of gas per day from perforations at 12,718-34 and 12,680-12,700 ft.

OFFSHORE

Two New Oil Sands At Ship Shoal Block 154

Two new oil pays have been established at Ship Shoal Block 154 field, off Terrebonne Parish in the Gulf of Mexico. Gulf Refining Co. 1-F OCS 0453 flowed 95 bbl. of oil and 1,004 M.c.f. of gas per day from perforations in the lower pay zone at 9,792-9,800 ft. Choke was 8/64-in. From the upper sand at 8,734-46 ft. the discovery flowed 203 bbl. of oil and 92.6 M.c.f. of gas per day from Miocene sands.

Two New Oil Sands Tapped At Grand Isle Block 47

Continental Oil Co. completed the 2-A State Lease 953 from two zones. The well is the confirmation to new Grand Isle Block 47 field, off Jefferson Parish in the Gulf of Mexico.

The well flowed at the rate of 295 bbl. of oil and 231 M.c.f. of gas per day from perforations at 10,494-10,500 ft.; from 9,220-28 ft. the well flowed 580 bbl. of oil and 288 M.c.f. of gas per day.

SOUTH TEXAS

Dual Oil Discovery Completed in San Patricio

Seaboard Oil Co. completed a dual-zone oil discovery 6 miles northeast of Sinton in San Patricio County.

The 1 R. H. Welder Estate "A," Section 12, Eliza H. Welder Subdivision, C. J. Francisco and E. Portilla Survey, Abstract 25, was finaled for 133 bbl. of oil per day on ⅛-in. choke from perforations at 5,932-36 and 5,947-52 ft. From perforations at 6,378-82 ft. the well flowed 142 bbl. per day.

New Oil Pay Opened At East Double Bayou

Kilroy Oil Co. and F. A. Callery, Inc. opened oil production in the East Double Bayou area, Chambers County. The 1 Schwartz Unit 1 flowed 7 bbl. of oil per hour on tests of perforations at 9,052-54 ft. This area was opened late last year at the 1 Manson K. Smith which made 16,000 M.c.f. of gas per day and some distillate at 9,032-42 ft.

Dry Gas Flows at Caplen Field Outpost

Christie, Mitchell and Mitchell 1 Caplen State Block 25, extension well to Caplen field in Galveston County, was completed as a dry gas well in basal Miocene sands at 4,350½-56½ ft. The well flowed 405 M.c.f. per day and is shut in. Location is in the M. Knowlton Survey, A-141.

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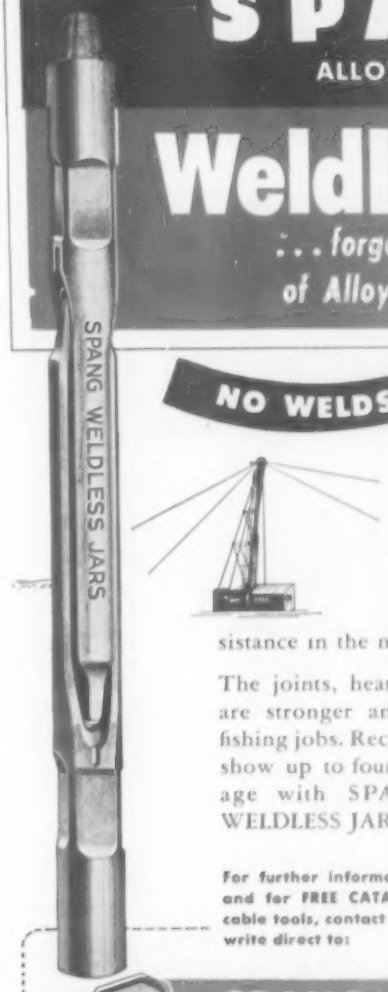

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WESTERN CANADA

ALBERTA

Hussar Gas Discovery Highlights Week's Activity

Highlighting Western Canada's exploration program the past week was a well in the Hussar area of southern Alberta being drilled by Tennessee Gas Transmission on a Mobil Oil of Canada, Ltd., farmout tract. This well, during drill-stem test operations in the Glauconitic sand flowed natural gas to the surface at the rate of 9,000,000 cu. ft. daily and also indicated success from the basal Blairmore formation where gas was measured at a rate of 2,890,000 cu. ft. daily.

This strike, T.G.T-Mobil-C. P. R. 10-1 Hussar, is on LSD 16, 10-24-20w4. It is 55 miles east of Calgary city limits, 1½ miles north-northeast of the Mobil-C.P.R. 3-6 Hussar basal Blairmore formation gas discovery well and 30 miles south of Drumheller city.

Test to indicate discovery was run over a 40-ft. interval, bottomed at 4,500 ft. Gas flowed to the surface immediately and in 2 minutes had reached a rate of 4,580,000 cu. ft. daily, in 7 minutes that rate increased to 7,730,000 cu. ft. daily. The well was then shut in after 10 minutes when the flow line blew out. After repairs were made to the line the well was again allowed to flow for 5 minutes and flow built up to 8,260,000 cu. ft. per day. The valve was then shut in and further repairs were carried out, when it was again opened gas reached the maximum rate of 9,000,000 cu. ft. daily. Latest report had crew laying down drill pipe at a depth of 4,525 ft.

Oil Flows at Bentley Area Discovery Well

The California Standard Co. has flowed oil in commercial quantity from an exploratory well in the Bentley area of southern Alberta, 2 miles northwest of 1 Imperial Oil, Ltd. oil discovery well in the area and 3 miles southeast of the Imperial 4-20 Bentley original oil discovery well in the area.

This test, Cal-Standard 10-10 Bentley is on LSD 10, 10-40-1w5, is on freehold rights owned outright by the firm and is 2 miles southeast of its Bentley 10-17 indicated oil success.

Drill-stem test was run of the interval 5,468 to 5,540 ft. Gas flowed to the surface in 7 minutes and built to a daily rate of 66,000 cu. ft. Oil reached the surface in 117 minutes and recovery in 1 hour through a 1-in. choke was 14.4 bbl. of clean oil. Crew is now setting production casing at a total depth of 5,577 ft.

Mississippian Pay Indicated At Leafland Discovery

Mobil Oil of Canada, Ltd., operated venture which had previously given oil encouragement in the Cardium and Viking sand horizons this week indicated gas success in the Mississippian limestone during drill-stem test operations. This well lies in the Leslieville area of central Alberta, 15 miles east and slightly north of Rocky Mountain House townsite and 34 miles west-northwest of Red Deer city limits.

The well, Mobil Oil 16-12 Leafland, on LSD 12, 16-40-5w5, was carried to a total depth of 8,130 ft. and crew is currently setting production casing to bottom. On that location, the drilling rig lies 8 miles south of the present limits of the Alhambra, Cardium zone oil producing field, 3½ miles north of the Imperial 1-33 Leslieville Cardium sand oil discovery well and 17 miles east-northeast of the Ferrier Viking sand oil pool.

During drill-stem test operations in the Mississippian formation, around the 7,900-ft. level, gas flowed to the surface in excess of 1,000 M.c.f. daily while earlier Viking tests recovered oil from the drill pipe measured at 300 ft.

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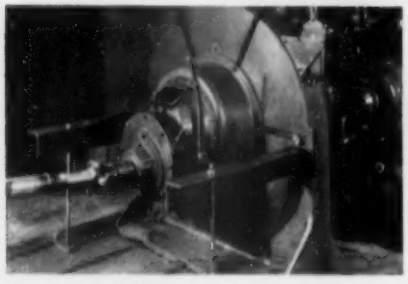

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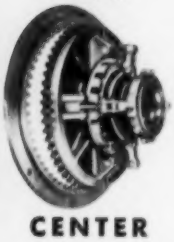

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CLUTCHES

Dual Zone Gas Hit Reported at Eaglesham

The Hudson's Bay Oil & Gas Co., Ltd.-Union Oil Co. of California team has discovered a dual zone gasser at its 1 East Eaglesham exploratory venture in the Eaglesham area of northwest Alberta. Discovery was chalked up in both the Gething and Cadomin zones during drill-stem test operations carried out at the wildcat during the past few days.

This strike, H.B.-Union 1 East Eaglesham, on LSD 11, 35-78-25w5, flowed gas from the Gething at a daily rate of 2,800,000 cu. ft. daily while Cadomin drill-stem test gave up natural gas at rate of 4,100,000 cu. ft. daily.

The well is being deepened below the 2,899-ft. mark, which was also bottom of the test in the Cadomin.

MID-CONTINENT

OKLAHOMA

Big Summer Drilling Program Is in Evidence

Oklahoma operators are looking for a busy summer of exploratory and development drilling as a result of important discoveries in all sections of the state. Leading interest areas are in Grant, McClain, Harper, Marshall, and Okfuskee counties.

Grant . . . Seneca Oil Co. completed a new discovery well in the Wakita area on the fast-growing Cherokee trend of northern Grant and Alfalfa counties.

The 1 Lewis, SW NW 26-28n-7w, flowed 85 bbl. of oil per day on small choke plus 1,026 M.c.f. of gas from perforations in the lower Pennsylvanian sands at 4,880-88 ft.

Barrett Petroleum Co. and Kay County Gas Co. 1 Lewis, NW SE 33-28n-7w, is a Mississippi chat discovery at 4,972-5,020 ft. This well flowed 4,750 M.c.f. of gas and 15 bbl. distillate per million.

This section of Oklahoma is having an active lease and seismic play, particularly near the common corners of Alfalfa, Woods, and Major counties. Development along the Cherokee trend is expected to continue at a brisk pace.

McClain . . . Gulf Oil Corp. opened an important new pool in this South Central Oklahoma area at 1 Dyer, SE SW NE 20-6n-3w.

The well flowed more than 2,000 bbl. of oil per day from the Hunton lime and Bromide sand. From the Hunton at 8,955-97 ft. the well made 317 bbl. in 14 hours. From the Bromide sand at 10,100-10,200 ft. the well flowed 1,500 bbl. per day. Development here will continue on 40-acre spacing. Carter Oil Co. is starting work at another Bromide area in 11-5n-2w.

Harper . . . Harper County in northwestern Oklahoma is the outstanding exploratory and development interest point this year.

Center of Harper activity is the Laverne district. Wildcat activity throughout this area is expected to increase considerably, backed up by strong development programs.

An-Son Petroleum Co. completed the 1 Freeman discovery in 6-27n-25w, flowing 2,426 M.c.f. of gas per day from the Morrow sand at 6,520-30 ft. This well is at the north end of the Laverne play. The operator will drill wildcats in the intervening area.

Cities Service Oil Co. expanded Northeast Laverne field at 1 McClung-A, NW NW SE 11-26n-25w. This Chester-Mississippian discovery flowed 10,500 M.c.f. of gas per day from perforations at 6,945-66 ft. It also made 100,000 M.c.f. per day from the lower Tonkawa sand perforations of Pennsylvanian age at 5,455-70 ft. Gulf Oil Corp. has a discovery at 1 Laverne-State in 13-26n-25w. Both Hoover and

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Morrow sand production are indicated. Gulf also has an oil discovery in East Laverne field with production from the Morrow. The well flowed 83 bbl. per day on ½-in. choke from perforations at 6,922-7,000 ft. From the Hoover sand it made 3,880 M.c.f. from 4,160-4,210 ft.

Sun Oil Co. has a gas discovery at 1 Carlisle in 25-26n-25w. Production is from the Hoover. Monsanto et al. are drilling a wildcat in C SW SE 17-27n-23w, known as the 1 Cosby. Woods Petroleum Co. will drill 1 Seevers in C NW NW 6-27n-20w. Other activity includes Sunray's Tonkawa gas discovery at 1 Hill in 6-25n-25w. This well flowed 5,020 M.c.f. per day on test of the Tonkawa at 5,634-77 ft. Sunray is drilling two offset wells in 33 and 34 of 26n-25w, South Laverne field. Inland Oil Co. has a wildcat location staked in 28-28n-22w. Eason Oil Co. and Wilcox Oil & Gas Co. have a highly important wildcat drilling in the Morrow at 1 Hovey, 8-25n-23w. This well reportedly found a thick pay sand in the Hoover at 4,353 ft.

While the Laverne area seems to have the lion's share of the activity, the nearby Stockholm field is being revived. Oil Capitol Corp. will try for an extension discovery at Southwest Stockholm field, 14-26n-24w. Production here is from the Tonkawa.

On the west side of the Laverne play area Hoover sand production is moving into 1 and 12 of 26n-26w, indicating possible expansion into Beaver County.

Marshall . . . The Texas Co. has a Hunton lime discovery at 1 Vanderpool, SW SW SE 2-6s-6e. The well recovered 130 ft. of oil on drill-stem test at 4,825-45 ft.

Blackwell Zinc Co. is developing a new Springer sand pool at Aylesworth. The shallow area has wells making 50 bbl. per day. Location is 5-6s-6e.

Development at North Madill continues to highlight southern Oklahoma drilling. Sinclair Oil & Gas Co. is completing good wells for more than 1,000 bbl. per day. There are eight pay zones, but most big wells produce from the second and third Bromide and the McLish sands.

Okfuskee . . . Amerada Petroleum Corp. opened a promising new field at Southeast Laffoon.

Dutcher sand production is being expanded at a rapid pace in 29, 30, 31, and 32 of 13n-7e. The sand is at 3,750 ft. Other sands appear to be productive. A Red Fork discovery was completed in SW SE SE 26-13n-7e by Amerada, flowing 7,100 M.c.f. of gas per day.

New Pay Reported At East Foster in Garvin

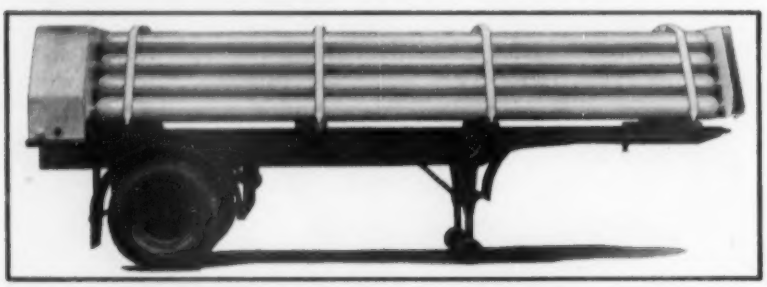
The Layton sand of Pennsylvanian age is a new pay at East Foster field, Garvin County, south-central Oklahoma. Jake L. Hamon and Magnolia Petroleum Co. 1 Mercer Unit-B, C SE NE 25-2n-3w, flowed 172 bbl. of oil per day on ¼-in. choke from perforations at 6,280-92 ft. After load was recovered, the well flowed 200 bbl. per day through open casing; on ½-in. choke it made 32 bbl. hourly.

Extension Reported At New Southeast Laffoon Field

Amerada Petroleum Corp. moved production to the west at newly opened Southeast Laffoon field, Okfuskee County. The 1 Johnson, SE SW SE 30-13n-7e, recovered 590 ft. of clean oil on a drill-stem test of the Dutcher sand at 3,765-93 ft.

Lincoln County Field Adds New Extension Area

Jerigan and Morgan 1 Mercer, SE SW NE 9-13n-3e, is a new extension to the Happy Hill area, recently opened as a new Cleveland sand pool at a workover well. The 1 Mercer flowed 50 bbl. of oil per hour on drill-stem



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test at 3,596-3,613 ft. The next field to the west produces from Bartlesville-Pennsylvanian sand. The pool to the north has Skinner sand-Pennsylvanian oil.

Penn Pool Opened At Cleveland Extension

A basal Pennsylvanian discovery was made at Lone Star Producing Co. 1 Miller, an outpost well ½ mile south of Northeast Moore pool in Cleveland County. The well, located in C SW NW 13-10n-3w, recovered 1,800 ft. of oil on drill-stem test at 7,477-7,504 ft.

KANSAS

Casing Set at New Pratt County Discovery

K. & E. Drilling Co. et al set casing at a new pool prospect in western Pratt County on the Pratt anticline. The 1 Haskins, NE NW NE 5-27s-14w, recovered 30 ft. of oil and gas-cut mud, 60 ft. heavily oil and gas-cut mud, 120 ft. of frothy oil, and 60 ft. clean oil on drill-stem test in the Lansing-Pennsylvanian at 4,031-46 ft.

The wildcat also tested the Mississippian, gettting 300 ft. of gas-cut mud: from the Viola at 4,390-4,432 ft., the wildcat made 30 ft. gas-cut mud and 180 ft. of oil and gas-cut mud.

Operator Shuts In Barber Gas Discovery

Pickrell Drilling Co. shut in its 1 Slinker gas discovery in eastern Barber County. The well, located 2 miles northwest of Sharon pool in NW NW NW 11-32s-10w, gaged 3,500 M.c.f. of ges per day.

Wildcatting Picks Up In Northwest Kansas

Six new wildcats were announced in northwestern Kansas counties last week. The new tests will go down in Decatur, Ellis, Graham, Rooks, and Sheridan counties.

Intent to Drill Notice Now Required by Officials

The Kansas Corporation Commission has announced the adoption of a new "Intent to Drill" requirement, effective last May 21. The ruling reads: "Prior to the commencement of drilling operations, the owner or operator thereof shall give written notice to the Conservation Division of his intention to drill any well for the discovery of oil or gas, which notice shall contain: (1) the name and address of the operator; (2) the name, number, and location of the well; (3) the approximate date drilling will begin; (4) estimated total depth; (5) amount of surface pipe to be run; (6) type of drilling equipment to be used; (7) any other information requested by the Commission."

Lansing Discovery Reported At Stafford Wildcat

Natural Gas & Oil Corp. is installing pump and tanks at its 1 Dudrey discovery in NE SW SE 19-24s-13w, 1 mile northeast of Harter pool in Stafford County.

The wildcat flowed 150 bbl. of oil in 2 hours from perforations at 3,885-90 ft. in the Lansing-Pennsylvanian. Final gage was 5½ bbl. per hour for 3 hours on ¼-in. choke.

In southern Stafford County McKnab Drilling Co. is putting up pumping equipment at its 1 Goodman discovery in NE SE NW 6-25s-13w, 1 mile northwest of Seevers pool. The Mississippian gaged 2,030 M.c.f. of gas per day on drill-stem test. There was

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good oil saturation in the 50-ft. Lansing zone. The operator set casing in the Arbuckle at 4,192 ft. Swabbing brought 20 bbl. of oil per hour.

NORTH TEXAS

Wise County Conglomerate Discovery Finished

K & H Operating Co., Christie, Mitchell & Mitchell 1 Gasperson, Wise County wildcat 2 miles north of Bridgeport, has been completed as a conglomerate discovery.

Initial potential was 224 bbl. of 43.8° oil a day through 16/64-in. choke. Pay was perforated from 5,496-5,502 and 5,536-40 ft. Gas-oil ratio was 850:1, and tubing pressure was 780 psi. Location is in the S. Wood Survey, A-896.

New pay opener . . . Tannehill sand production has been added to the South Lueders (King sand) field in eastern Jones County. The opener is The Texas Co. 3 Jennings which drilled to 2,067 ft., then plugged back to 1,680 ft. Pay section from 1,630-36 ft. produced 87.42 bbl. of 34° oil in 6 hours on the pump.

Nolan County new pay . . . Ellenburger oil has been opened in the Nena Lucia field at Honolulu Oil Corp. 3 Spires, in 124-1A-H&TC, southwest of Maryneal. On completion test the well pumped 178 bbl. of oil a day from perforations at 7,360-78 ft.

The well was completed in April from the Strawn at 7,360-78 ft., for a flowing potential of 673 bbl. through ¾-in. choke.

Taylor County prospect . . . Miami Operating Co. set pipe for completion attempt in the Fry sand at its 2 E. P. Herber, new-pay prospect and south extension to the Herber field. Production from the Fry sand was indicated with recovery of 750 ft. of oil on drill-stem test between 4,367-75 ft. A test of the Gray sand at 4,864-76 ft. reeovered mud with no shows.

WEST TEXAS-NEW MEXICO

WEST TEXAS

Irion County Active; Discovery Completed

Irion County has shown a steady gain in drilling and exploration over the past 6 months. Last week a count of active rigs showed 24 drilling, which included 8 listed as stratigraphic tests.

In eastern Irion, Russell Maguire 1-B Sugg, 2 miles northwest of Mertzon, completed for a flowing potential of 103 bbl. of 36° oil a day. The flow

was through 20/64-in. choke, from pay at 6,472-86 and 6,497-6,514 ft. Gas-oil ratio was 1,950:1.

This well, located in Section 42, C. A. Chadwick Survey, was drilled as a tight hole, to 7,877 ft., then plugged back to 6,810 ft.

Southeast of Mertzon, Woodward & Co. 1 Brooks was ready for completion as a dual discovery. On tests of perforations in the Leonard (Middle Permian section), at 5,127-37 ft., the well kicked off and flowed 16 bbl. of oil an hour on ¼-in. choke. Flowing pressure on tubing ranged to 780 psi.

Second pay is the Strawn sand, where perforations at 6,497-6,507 ft. flowed oil at the rate of 9 to 12 bbl. an hour.

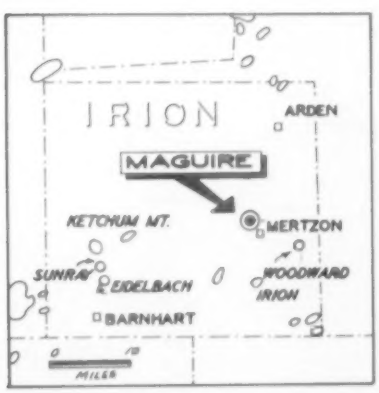
No. 1 Brooks was drilled on a farmout from M. D. Bryant and Bryant Williams, San Angelo, and had dry-hole support money from Standard Oil Co. of Texas, Balboa Oil Co., Wilshire Oil Co. and Suniland Oil Corp. contributed acreage.

The dual discovery is 5 miles northeast of Irion field, and 11 miles northeast of the recently opened Sixty-Seven (Strawn) field, opened by British American 1 Noelke.

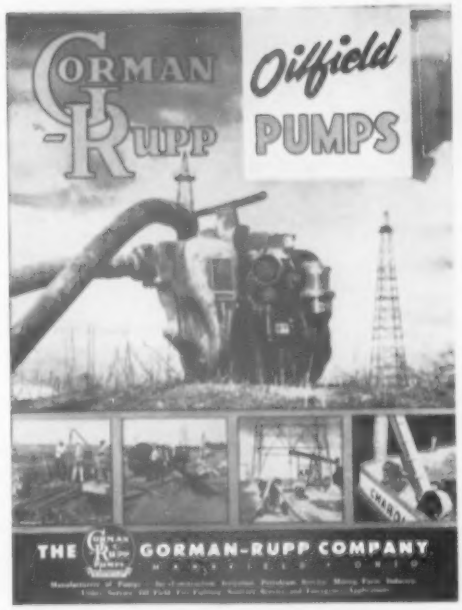
In the Sixty-Seven field, British American has scheduled its 2 Noelke as a southwest offset to the discovery.

Sunray Mid-Continent Oil Co. 1 Elta Murphy, Clear Fork prospect 5 miles north of Barnhart, reported good shows of oil after perforating at 4,592-99, 4,616-21, and 4,660-65 ft. Operators were moving in a pumping unit for completion attempt at last report.

Mark A. Eidelbach 1 Edward Ashe, wildcat 4 miles north of Barnhart and southeast of Sunray's 1 Murphy, was ready for completion after flowing at the rate of 13 bbl. of oil an hour from



Irion County is now one of the hot spots in West Texas, with 24 operations listed. Discoveries shown above are Russell Maguire 1-B Sugg, completed, and Woodward & Sons 1 Brooks, now ready for completion. Maguire's well was not identified as to pay zone. Woodward's well was a dual discovery, from Permian and Pennsylvanian sections. Sunray and Eidelbach tests are discovery prospects.



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the Clear Fork. Total depth was 4,900 ft. at last report and testing was through perforations at 4,620-40 ft. Location is in Section 40, Washington County RR Survey.

Sunray Mid-Continent is drilling a west offset to the Eidelbach well, as the 1 Elta Murphy "A." It was near contract depth of 5,000 ft. and had indicated production from cores between 4,556-76 ft.

Sinclair Oil & Gas Co. has moved in to drill a 4,800-ft. Clear Fork wildcat 4½ miles north of the Eidelbach well. Test will be the 1 Claude Becton, in SE SE Section 78, Block 14, H&TC Survey.

Book Review

Phifer Petroleum Publications has released the sixth in its $10 series of Petroleum Reviews of West Texas' oil producing counties. This volume is devoted to a study of the oil and gas fields of Winkler County, Texas.

It contains a detailed history of the county's 37 oil fields, starting with the first discovery in 1926 and carrying the study up to May 1, 1956. In these 30 years, Winkler County has produced a total of 485,944,327 bbl. of oil. The largest field in the county is the Hendrick field with a total production of 226,027,819 bbl.; this was also the first field to be discovered in the county.

The volume is replete with structural maps, type logs, and charts. It may be ordered from Phifer Petroleum Publications, Box 20024, Houston.

ROCKY MOUNTAIN

MONTANA

High Drilling Level Reported at Wolf Springs

Wolf Springs field activity in Yellowstone County on the Montana Plains continues to lead development in the northern Rockies. The week's tally is three new producers, one coring in the field's pay zone, the Amsden dolomite, and three new locations announced.

Carter Oil Co. is testing at the 1 White in C NW SW 28-7n-32e at the south end of the reservoir. Coring is also reported at the 3 Horton in C SE SW 29-7n-32e. These wells flowed oil on drill-stem tests of the Amsden. Carter staked two new locations, at 4 Horton in C SE NE 29-7n-32e, and at 1 Nellie White, C NW NW 33-7n-32e.

Carter is completing the 1-A C. S. Horton in the north part of the field, C SE NW 19-7n-32e, ½ mile south of the discovery well of the field. Atlantic Refining Co. is finishing up the 18-3 Horton in C SE NE 18-7n-32e, and has staked location at 18-4 Horton in C SE SE 18-7n-32e.

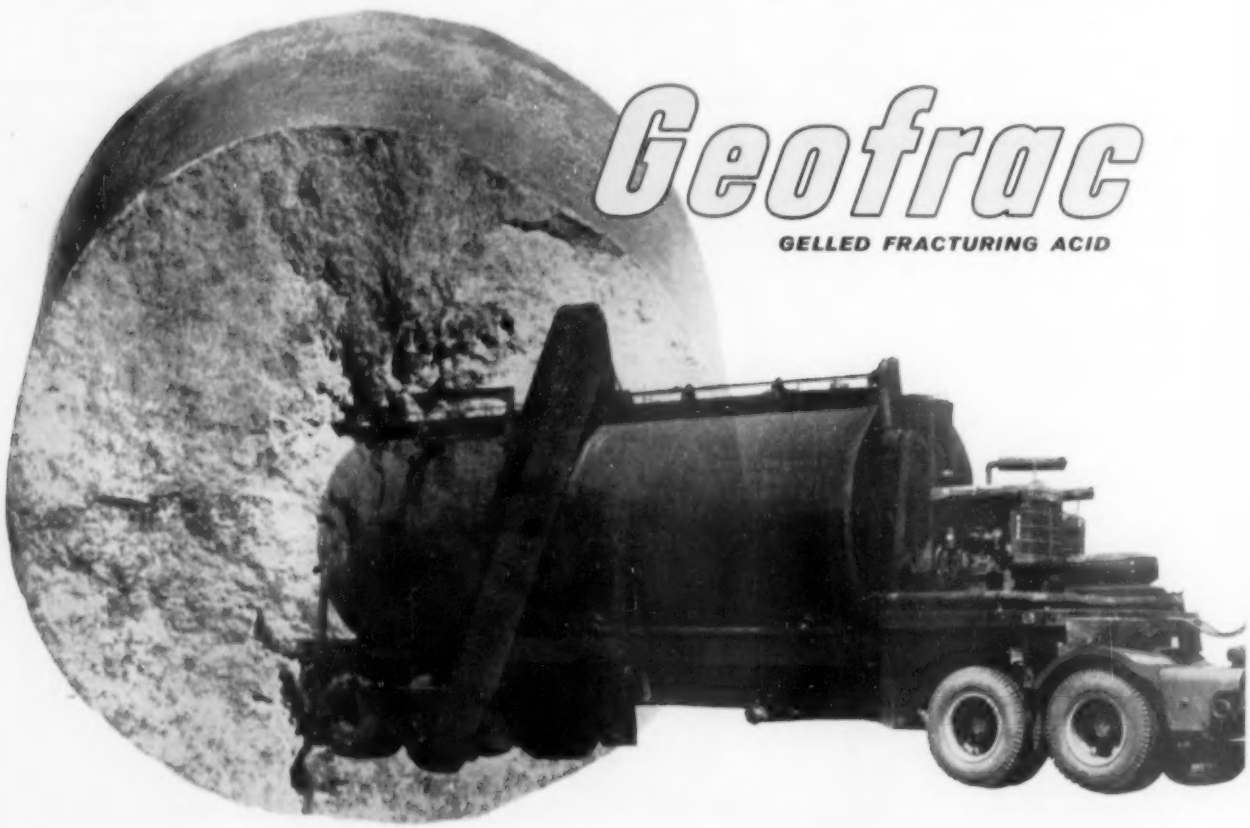
WYOMING

Dakota Discovery Completed At Donkey Creek

An important discovery for the east side of the Powder River basin was complete last week flowing 650 bbl. of oil per day from the Dakota sand. The strike is True Oil Co. et al. 4-B Burroughs, C SW NW 8-49n-68w, Crook County.

The discovery flowed 650 bbl. per day on ½-in. choke from perforations at 6,362-6,404 ft. This is the first good Dakota production in this region except for Lance Creek field. The 3-B Burroughs was completed for 260 bbl. per day, also from the Dakota. Location is in C NW NW 8-49n-68w. The 2 Burroughs in C NE SW 8-49n-68w, is being perforated.

Production in this Donkey Creek field area is from stratigraphic traps. The pay sands are up to 33 ft. thick.



Successful Wildcats

ALBERTA

Tennessee Gas Transmission Mobil 20-1 Consort, LSD 11, 20-36-7w4. TD 2,746. ft. Viking gas well.

Mobil Oil 18-11 Chestemere, LSD 11, 18-24-28w4. TD 8,587 ft. Crossfield gas well.

Seaboard Great Plains Baysel E-6-18 Buck Lake, LSD 6, 18-47-6w5. TD 7,486 ft. Cardium oil well.

BRITISH COLUMBIA

Phillips 1 Kobes, 56° 29' N. Latitude, 122° 02' W. Longitude. TD 7,769. Shut-in gas well. (Three zones, Cadomin, Triassic, Mississippian).

CALIFORNIA

Kern County, Union Oil Co. 73-2 Smith, SE NE 2-30s-25e, 139 BOPD, 34° gravity, Perfs. 9,741-9,810 ft., TD 10,163 ft. (New Stevens sand discovery 1 mile N of Polvadero area of Strand field.)

Los Angeles County: The Texas Co. 13 Honor Rancho A, NE NW 8-4n-16w, 1,065 BOPD, 37.6° gravity, 18/64-in. choke, perfs. 8,900-50 ft., TD 8,975 ft. (New pool discovery ¾ mile SE of production in Honor Rancho field.)

San Joaquin County: Humble Oil & Refining Co. 1 Lester M. Raggio et al, NW NW 9-1n-5e. IP 5,073 M.c.f. daily, ¼-in. choke, perfs. 5,270-77 ft. TD 5,500 ft. (New gas discovery 3 miles southeast of McDonald Island gas field).

COLORADO

Washington County: The Chicago Corp. and Republic Natural Gas Co. 1 State-De Nova, NW NW NE 16-2s-49w. IPP 121 BOPD, "J" sand discovery, new field. TD 3,734 ft.

KENTUCKY

Christian County: P. L. Pitzer 1 Spurlin, SW SW SW 12-G-27. IPP 6 BOPD, lower O'Hara 669-80 ft. TD 680 ft. (Discovery of Spurlin pool.)

Muhlenberg County: Tuley Drilling Co. 1 Lile, NW NE SW 19-11-27. IPP 4 BOPD, Jackson sand 715-27 ft. TD 1,165 ft. (Discovery of Long Creek pool.)

SOUTH LOUISIANA

Acadia Parish: Dillard & Waltermire Drilling Co. 1 Boudreaux, 17-10s-2e. IP 68 BCPD and 3,216 M.c.f. daily, ⅛-in., 49.2°, perforations 13,936-43 ft. TD 15,025 ft. (New field).

Cameron Parish: Superior Oil Co. 1-A Bureau of Land Management, Block 72, West Cameron area, Gulf of Mexico. IP 92.4 BOPD, ⅛-in., 32.9°, perforations 12,258-75 ft. TD 13,339 ft. (New field).

Jefferson Parish: Continental Oil Co. 2-A State Lease 953, Block 47, Grand Isle area, Gulf of Mexico. IP 581 BOPD, ⅝-in., 31.9°, perforations 10,494-10,500 ft. TD 16,189 ft. (New pay in Grand Isle Block 47 field).

St. Charles Parish: Shell Oil Co. 1 State Lease 2918 (Tract 6375). Block 41, Lake Ponchartrain. IP 1,600 M.c.f. daily, ⅛-in., dry gas, perforations 8,808-24 ft. TD 10,984 ft. (New field).

MISSISSIPPI

Jefferson County: Jet Drilling Co., Inc., 1 Wagner, 50-10n-1w. IPP 60 BOPD, 39°, perforations 3,920-21 ft. (Wilcox). TD 4,004 ft. Elev. 190 ft., Wilcox 3,607 ft. (Discovery well of North Fayette field).

MONTANA

Musselshell County: R. P. Oliver 3 State, C SW SW 16-11n-31e. IPF 235 BOPD, Heath sand discovery, new pay, TD 4,086 ft. Heath.

NEBRASKA

Cheyenne County: Miracle-Fifer Drilling Co. 1 Anderson, C NW SE 12-15n-53w. IPP 175 BOPD, "J" sand discovery, new field. TD 5,588 ft. "J" sand.

OKLAHOMA

Alfalfa County: N. T. Smith 1 Bodle "A," 1⅛ mi. northeast of Mendon field in C NW SW 15-28n-9w. IPF 26 BOPD, Bartlesville sand 5,052-68 ft., 20/64-in. choke, 30°, TD 5,097 ft. (Oil discovery in Cherokee trend).

Beaver County: Stanolind Oil & Gas Co. 1 Campbell, 3¼ miles southwest of Southwest Camp Creek field in NW NW SE 5-2n-24eCM. IP 11,396 M.c.f. of gas per day, Chester-Mississippian 7,252-72 ft. TD 7,800 ft. (Gas discovery in Hugoton embayment).

Harper Oil Co. 1 Bass, 1½ miles north of Southwest Camp Creek in C SE SE 14-3n-24eCM. IPF 150 bbl. dist. per day, 12,468 M.c.f. of gas per day, Missouri 5,372-88 ft. TD 5,502 ft. (Gas-distillate discovery in Hugoton embayment).

McClain County: Gulf Oil Corp. 1 Dyer, SE SW NE 20-6n-3w. IPF 336 BOPD, Hunton 8,955-97 ft.; 455 M.c.f. of gas same zone, ½-in. choke, 44°, 1,496 BOPD, Bromide sand and 1,800 M.c.f. of gas per

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day, 10,100-10,200 ft., ½-in. choke, 42°, TD 11,134 ft. (Oil discovery).

Okfuskee County: Amerada Petroleum Corp. 1 Littrell, ¼ mile east of West Hilliby in SW SE SE 26-13n-7e. IP 7,120 M.c.f. of gas per day, Red Fork sand 3,090-3,105 ft., 46/64-choke. TD 3,754 ft. (Gas discovery.)

SOUTHEAST NEW MEXICO

Lea County: D. D. Feldman Oil & Gas Co. 1 Elliott-Federal, 27-11s-38e. IP 88 BOPD, ⅜-in., TP 50 psi., GOR zero, 42°, Wolfcamp 9,536-56, 9,466-80 ft. TD 12,218 ft., elev. 3,896 ft. Top Devonian 12,070 ft.

Humble Oil & Refining Co. 1 South Four Lakes Unit, 2-12s-34e. IP 304 BOPD, 12/64-in., TP 1,275 psi., GOR 2552, 44°, perforated Pennsylvanian 10,227-57 ft. TD 12,222 ft., elev. 4,160 ft.

WEST TEXAS

Ector County: Felmont Oil Corp. 1 Roy Parks, 33-41-T1S-T&P, 7 miles NW Odessa. IP 232 BOPD, 25/64-in., TP 215 psi., GOR 1184, 43°, Wolfcamp 10,020-52 ft. TD 11,384 ft., elev 3,004 ft.

Pecos County: Brown & Thorp 1 Barnes, 138-10-H&GN, 5 mi. W Owego. IP 3,030 M.c.f. gas, Yates 747-753 ft. TD 3,201 ft.

Reeves County: Ford Chapman 1 Ramsey "1-18," 18-57-T1-T&P, 10 miles NW Orla. IP 251 BOPD, 16/64-in., TP 990 psi., GOR 1930, 42°, Delaware sand 2,630-43 ft. TD 2,643 ft.

NORTH TEXAS

Archer County: The Texas Co. 2-A Edwards, L. P. Hunt Subd., 2½ miles NW Scotland. IP 133.6 BOPD, ¼-in., TP 80 psi., GOR 305, 39°, conglomerate 5,455-61 ft. TD 5,600 ft.

Grayson County: Gas-distillate discovery, originally completed from Ordovician at 10,354-10,482 ft. New IP 9,400 M.c.f., open flow, plus 473 bbl. condensate per day, perforations 9,959-61, 9,968-71, 9,973-76 ft. Suggested new field name, Sherman-9,900 ft. sand.

NORTH DAKOTA

McKenzie County: Amerada Petroleum Corp. 1 Lacey-Norby, SE NE 1-152n-95w. IPF 312 BOPD, 14/64-in. choke. TD 9,118 ft. Madison discovery, new field.

WEST CENTRAL TEXAS

Fisher County: Warren D. Sorrels 1 Poe, 183-1-BBB&C, 4 miles N Hamlin. IP 369 BOPD, ⅜-in., TP 325 psi., GOR 924, 44°, Strawn sand 5,348-61 ft. TD 5,510 ft.

Taylor County: Drill Well Oil Co. 1-C Henry Sayles, J. Trussell Sur. 141, 7 miles SW Buffalo Gap. IP 116 BOPD, 14/64-in., TP 65 psi., 41°, GOR 150, Flippen sand 2,641-45 ft. TD 2,694 ft.

EAST TEXAS

Red River County: Don Fitzwater 1 Cole, Whitfield Moore Sur., 15 miles NE Detroit. IPP 11 BOPD, 14°, GOR zero, Paluxy 1,773 ft. TD 1,785 ft.

SOUTHWEST TEXAS

Brooks County: Mills Bennett Estate 25 Mills Bennett Estate fee, Palo Blanco Ysidora Grant, A-258. 111.8 BOPD, X-30 choke, 45.7°, perforations 4,944-50 ft. TD 6,140 ft. (New pay in Mills Bennett field).

Jim Wells County: LaGloria Oil & Gas Co. 5 Stewart-Jones Unit 1, J. E. Stevens Sur., A-442 and 444. IP 29 BOPD (net), 3/32-in., 40°, 35 per cent water, perforations 7,300-03 ft., and (dual completion) 23,000 M.c.f. daily, GOR 79.9 M.c.f. per bbl., 55.4°, perforations 7,732-35 ft. TD 7,802 ft. (New pay in T-C-B field).

Zapata County: Aguila Oil & Gas Co. 1-A Leonard Haynes Est., SW 21, Ville Grant. IPP 17.96 BOPD, 18.8°, perforations 221-27 ft. TD 230 ft. (Discovery well Aguila field.)

TEXAS GULF COAST

Willacy County: Superior Oil Co. 1 Chess Todd, Lot 2, Block 1, Narcisso Tract 4, San Juan de Carricitos Grant, A-8. IP 81 BOPD, 6.5/64-in., 40.6°, perforations 7,677-89 ft. TD 9,500 ft. (New pay in Chess field).

TEXAS PANHANDLE

Ochiltree County: M. A. Machris 14-131 P. A. Harbaugh, 23 miles south of Perryton in southern part of county, 2 miles north of gas production in Sec. 131, Blk. 13, T&NO Sur. IPF 24,000 M.c.f. of gas per day from upper Morrow sand perforations at 8,694-8,720 ft. TD 9,648 ft. (Gas discovery in Hugoton embayment.

Roberts County: Stanolind Oil & Gas Co. 1-B Lips Ranch, 15 miles southeast of Spearman in northwestern part of county, Sec. 31, Blk. A, H&GN Sur. IPF 15,000 M.c.f. gas per day from lower Morrow sand at 8,494-8,526 ft. TD 9,455 ft. (Gas discovery. Old well drilled deeper).

WYOMING

Johnson County: Shell Oil Co. 1 Government, C SW SW 5-46n-81w. IPP 81 BOPD, 142 BWPD. Tensleep discovery, new field. TD 13,030 ft. Madison.

Sweetwater County: Carter Oil Co. 1 Unit, C SW SW 29-21n-103w. IPF 887 M.c.f. of gas per day, Frontier sand discovery, new field. TD 4,661 ft.

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A.I.C. honor another step in . . .

. . . Parkhurst's Meteoric Career

WHEN the American Institute of Chemists bestowed its highest honor on George L. Parkhurst recently, the Standard Oil Co. of California executive tucked away another tribute to his outstanding abilities.

Latest measure of Parkhurst's success, which had already been gaged by his meteoric rise in the petroleum industry, was the A.I.C. Honor Scroll.

He won the award for work in integrating the chemical and administrative phases of the petroleum and petrochemical industries and his "inspirational guidance and example of achievement to all chemists."

The recognition by A.I.C. reflects the wide regard for his activities in gearing the work of research chemists to the ever-growing and changing demands on the petroleum industry.

In a way, the A.I.C. award echoed the recognition Parkhurst had already received from Standard of California. In 10 years with the firm, he has risen to vice president and member of the board.

The soft-spoken Parkhurst, who is admired and respected by his subordinates for his courteous and efficient administration, has also won the respect of a host of friends and business associates alike. Their expressed opinion of the honor to Parkhurst:

"It couldn't happen to a nicer person."

Solid foundation . . . Born in Evanston, Ill., January 10, 1907, Parkhurst started early to prepare himself for his dual role of chemist-administrator. His collegiate career included stints at Illinois Institute of Technology, University of Chicago, De Paul University, Northwestern University, and Chicago's Kent School of Law.

After receiving his chemical engineering degree from Illinois Tech, Parkhurst stayed on at the school for 3 years of postgraduate work. He then spent 4 years at De Paul University, where he received his law degree. He was admitted to practice before the supreme courts of Indiana and Illinois.

During part of his college training and following it, he was employed by Standard Oil Co. (Ind.) where he served until 1941, attaining the position of senior patent attorney.

At the outset of World War II, he was named assistant director of refining and contract executive for the Petroleum Administration for War. It was in this position that he guided the

nation's refineries in the development and production of vitally important 100-octane gasoline.

He was responsible for approving process plants, contracts, and prices in connection with the 100-octane gasoline program.

Socal career.—Following the war, he was named president of Oronite Chemical Co., Standard of California's petrochemical subsidiary.

In 1949, he was elevated to chairman of the board of Oronite and made a vice president of the parent company, Standard of California. He was also made chairman of the boards of California Research Corp. and California Research & Development Co.

Last October he was named to Standard's board of directors. He is also a member of the boards of Arabian American Oil Co. and Trans-Arabian Pipe Line Co.

When not puttering around the garden of his home across the bay from San Francisco in Piedmont, he can usually be found on week-ends busily engaged in stamp-collecting activities with his three sons. They are Peter, 18; Perry, 16; and Paul, 15.

Parkhurst has been an active supporter and member of organizations and clubs related to his profession both in California and the Midwest. His present affiliations include American Chemical Society, Society of Exploration Geophysicists, Chemists' Clubs of Chicago and New York, San Francisco Stock Exchange Club, Alpha Chi Sigma, Tau Beta Pi, Phi Lambda Upsilon, and Delta Theta Phi.

Personals

R. C. Charles, Phillips Petroleum Co. district geologist at Albuquerque, has been promoted to division development geologist at Midland, Tex.

H. L. (Press) Wilson has resigned as assistant manager of Oil Trading Associates, Inc., at Wichita, Kans., to become an independent operator.

Dodd N. Osburn has been promoted to district geologist for the New Orleans district of Union Producing Co. He had been geologist for the firm since 1948.

Robert E. Baker, Jr., has been elected a director and vice president in charge of operations for General Gas Corp., Baton Rouge, La.

Cody R. Spencer, president of General Petroleums of Canada, Ltd., has been elected president of the Calgary Petroleum Club.

George R. Elliott has opened offices as a petroleum consultant in New York City. Since September 1953, he had been on petroleum engineering jobs for the United Nations Technical Assistance Administration in Turkey, Yugoslavia, and Argentina. Previously he served 17 years as a petroleum and reservoir engineer with Phillips Petroleum Co., Bartlesville, Okla.

F. J. Schempf has resigned as vice president and director of exploration for the Stanolind Oil & Gas Co. to become general manager of Louisiana operations for John W. Mecom, Houston independent oil operator. Schempf will supervise the extensive activities of Mecom in Louisiana, where the independent has equal interest in the world's deepest producer. Schempf had been with Stanolind since 1933 and had moved up through a succession of geological jobs. He was named a vice president and placed in charge of exploration in 1951. It was under his supervision that Stanolind became active in Cuba, Jamaica, and Canada.

Dr. Claude R. Hocott has been named head of Humble Oil & Refining Co.'s production research division. Dr. Hocott started with Humble in 1937 as a research engineer, becoming assistant head of the division in 1942.

Personals

PYRE

Augustin Pyre has been named general manager of Gulf Oil Corp.'s New York exploration division. He succeeds **Claude Woessner,** who retired after 29 years. The exploration division, formerly the New York production division, will be responsible for all exploration activities in Caribbean and South American countries except Venezuela. Pyre moves from Gulf Eastern Co. in London, England, where he was staff assistant in the exploration department.

Dr. Raymond Wynkoop has been appointed staff assistant to the president of Houdry Process Corp. and **Robert J. Mawhinney,** head of the firm's patent and licensing division, has been named vice president and member of the board. Dr. Wynkoop joins Houdry from International Minerals & Chemicals Corp. in Chicago.

K. W. Bumgarner has been named manager of Gulf Oil Corp.'s Kansas exploration zone, Wichita, and **O. P. Gilbert,** manager of the Eastern exploration zone, Evansville, Ind. The two zones are newly created from the old Kansas-Eastern exploration zone, in which Bumgarner and Gilbert were area managers. **C. L. Albert,** former zone exploration manager at Wichita, was transferred to Tulsa and assigned to the division land section.

John E. Bell has been appointed chief engineer of Sinclair Refining Co.'s manufacturing department in New York

J. E. BELL

D. E. HANSON

City, succeeding **Thomas D. Tifft,** who retired after 36 years with the company. **Donald E. Hanson** moves up to Bell's former job as assistant chief engineer. Bell served as project engineer and head of the central engineering department before transferring to New York in 1951. Hanson, former project engineer, moved to New York last year.

Irwin H. Delatte, Continental Oil Co. engineer trainee, has been transferred from Houston to Fort Worth.

Elbert F. Lee has resigned as engineer with Lone Star Construction Co. in Beaumont to join Texas Eastman Co. as mechanical engineer in Longview, Tex.

Kent Coale has resigned from Great Basins Petroleum Co. in Denver to join the production department of Luke Grace Drilling Co. in Wichita Falls.

J. Donald Roberts, process engineer with Continental Oil Co., has been transferred to Ponca City, Okla., from the firm's Baltimore, Md., petrochemical department.

Edward W. S. Nicholson has moved from assistant director of the Esso Research Laboratories at Baton Rouge, La., to the Esso Research & Engineering Co. at Linden, N. J. He is assistant director of the process division there.

John Floyd Baker, former South Texas division drilling superintendent for Loffland Brothers Co., is now drilling superintendent for Kilroy Drilling Co., Houston. Baker joined Loffland in 1928 at Seminole, Okla. He has been working in the Gulf Coast region of Texas and Louisiana for the past 21 years. He had been division drilling superintendent 9 years.

Dr. B. W. Thomas has joined Texas Butadiene & Chemical Corp. in Houston as head of the manufacturing research and control laboratory. He was formerly with Humble Oil & Refining Co. in Baytown, Tex. Others joining the firm: **Walter B. Simon,** formerly with Corn Products Refining Co. in Corpus Christi, maintenance superintendent; **Dr. T. H. Goodgame,** from Godfrey L. Cabot, Inc., head of research and development; **M. L. Riddick,** from Magnolia Petroleum Co., head of corrosion and inspection; **J. M. Hause,** from Cabot Carbon Co., terminal supervisor. New process engineers are **W. J. Brack,** from Olin Mathieson Chemical Corp.; **Robin M. Pate, Jr.,** from the Chicago Corp. at Corpus Christi; **Jerry G. Jenkins,** from Humble Oil & Refining Co., and **Robert A. Johnson. James L. Ainsworth** has been named chief chemist. He came from Warren Petroleum Corp.

Paul J. Clote has been promoted by Southern Union Gas Co. from exploration engineer in Dallas to assistant drilling superintendent in Farmington, N. M.

Wilbur R. Phillips has resigned as gas engineer with The Texas Co. in Snyder, Tex., to join Pecos Co. as gas engineer in Lubbock.

Mervin M. Miller has been promoted by Magnolia Petroleum Co. from field engineer in Vanderbilt, Tex., to plant engineer at the Sholem Alechem gasoline plant, County Line, Okla. **Jewel Alton Petty,** petroleum engineer, was transferred from Lindsay to Duncan, Okla.

R. L. Anderson is now assistant construction superintendent for Petro-Tex Chemical Co., Houston. He formerly was superintendent of Franklin Gas Co. there.

Milton B. Dobrin, formerly senior research technologist with Magnolia Petroleum Co., Dallas, is now geophysicist with Triad Oil Co., Ltd., in Calgary, Alberta.

Anthony J. Bruno, Jr., former chief engineer for Escambia Bay Chemical Corp., Pensacola, Fla., has been named technical department head in the G.R.E.X. polyolefin resin plant now being built in Baton Rouge by W. R. Grace & Co.'s polymer chemicals division.

Ray N. Plummer has joined Oilfield Research Laboratories in Chanute, Kans., as petroleum engineer. He was formerly district engineer for Continental Oil Co. at Great Bend, Kans.

Cliff W. Peery, manager of operations for the Mene Grande Oil Co. in Caracas, has been elected a vice president and member of the board. Peery joined the parent Gulf Oil Corp. in 1934, moving to Mene Grande a short time later.

Arthur J. Robnett is now staff geologist in Pure Oil Co.'s division headquarters in Tulsa. He was geologist in the company's Ardmore exploration office. **Richard Ross, Jr.,** geologist in the Ardmore office, has moved to the Amarillo, Tex., office, switching places with **George A. Bradley. Donald M. Taylor,** geologist, has moved from Tulsa to Ardmore.

E. Clyde McGraw, executive vice president of Transcontinental Gas Pipe Line Corp., has been made a director. He has been head of operations since joining the company in 1950 as a vice president. McGraw was made executive vice president last November. Before joining Transco, he was vice president of Stone & Webster Service Corp. in New York, acting as adviser to natural-gas companies.

Dr. Willard M. Dow has been named director of research by Texas Gas Corp. He was formerly assistant director of research with United Gas Corp. His new job will include recovery of petrochemicals from Texas Gulf Coast gas reserves.

A. E. McKay, Continental Geophysical Co., is the new president of the Fort Worth Geophysical Society. **R. C. Herron,** Gulf Oil Corp., is vice president, and **V. S. Balderson,** Pure Oil Co., secretary-treasurer.

L. W. Hamilton has been promoted to group leader in the process development section of the research and development department of American Oil Co. in Texas City.

John W. Towler has been named manager of Union Oil Co. of California's Los Angeles refinery. He formerly was manager of Union's Oleum refinery. **Dr. Henry C. Meiners,** previously manager of the Los Angeles refinery, is now process consultant at the firm's new Brea Research Center, and **M. S. Thomson,** formerly general superintendent of operations and assistant superintendent at the Oleum refinery, has been named manager of that plant.

Philip A. Kahle, Jr., has been named general manager of refining for the Frontier Refining Co. in Cheyenne, Wyo. He was vice president of Refinery Engineering Co., division of Vitro Corp. in Tulsa. Kahle succeeds **Harry Brown,** who resigned to become vice president in charge of refining for D-X Sunray Oil Co. **Jay Olvey** was promoted from chief chemist to assistant refinery manager for Frontier. **Hallas Spencer** and **Tom A. Kirk** were named process foremen for plants 1 and 2. **G. Palmer Long** was promoted to maintenance and construction superintendent, and **Larry Nyston** was appointed office manager.

J. D. Hughes, engineer, has been transferred from Sinclair Oil & Gas Co. in Tulsa to Sinclair Research Laboratories, Inc., at Humboldt, Kans.

John O'Brien, of Amarillo, has been elected president of the Panhandle Producers and Royalty Owners Association, succeeding **Lawrence R. Hagy,** also of Amarillo.

Frank G. Kozak, formerly with Lowell Drilling Co. and Cimarron Western Drilling Co., has joined Garvey Drilling Co., Wichita, as Rocky Mountain contract representative in Denver.

Dr. Charles A. Swartz has been named division geophysicist of Gulf Oil Corp.'s Tulsa production division. He succeeds **William C. Lamb,** who was transferred to the New York exploration division as division geophysicist.

Harold G. Teverbaugh has been promoted to general superintendent by Texas Natural Gasoline Corp. and **John A. Sutherland** was moved up to chief engineer. Teverbaugh came to Texas Natural from the old Sunray Oil Corp. in 1953 as assistant manager of the gas division. Sutherland was formerly with Stanolind Oil & Gas Co.

John J. Collier, Jr., has been named assistant to the division manager of Pure Oil Co.'s southwestern producing division. He will continue as division exploration manager. Other changes: **Charles W. Hancock** was made assistant to the division manager in producing; **Charles L. Schneider** succeeds Hancock as assistant division production superintendent; **John R. Weyler** was moved up from senior engineer to assistant chief division production engineer; **Jerry J. Wasicek** was made senior production engineer in the Tulsa office engineering department.

Personals

E. W. Unruh has been made drilling superintendent and **Joe Gardenhire** business representative for Anschutz Drilling Co. Both are located in Casper, Wyo.

Gerald J. Lebow, former geologist at Midland for Kerr-McGee Oil Industries, has joined the consulting firm of Ashmore & Elwell.

Bruce J. Wyant, petroleum engineer with The Texas Co., has been transferred from Santa Paula to Long Beach, Calif.

Joe R. Black, Jr., formerly with Ohio Oil Co. in Bakersfield, Calif., has joined Warren Petroleum Corp. as reservoir engineer for the Sharon Ridge Canyon Unit at Snyder, Tex. **J. D. Freese,** petroleum engineer, has been transferred from Abilene, Tex., to the Houston office.

H. B. McClure has been elected a vice president of Union Carbine & Carbon Corp. in New York City, and **D. B. Benedict** was named president of Carbide & Carbon Chemicals Co., a division of Union Carbide.

Dr. Carlos E. Contreras, formerly a geologist with International Petroleum Co., Ltd., in Peru and later with Utex Exploration Co. in Utah, has formed Geo-Science Consulting & Engineering Co. in Tulsa.

Earl A. Nichols, former independent petroleum consultant, has been named consulting engineer for the recently organized Stekoll Properties. He has been associated with Carter Oil Co. and Core Laboratories, Inc., where he was assistant to the president and manager of the Mid-Continent division.

DEATHS

Charles N. Kimball, president, General Petroleum Engineers, died recently at Sistersville, W. Va. Kimball was associated with Carter Oil Co. from 1902 to 1907 at Sistersville, and was instrumental in 1917 in freeing to the petroleum industry the use of air and gas injection into wells to increase oil production.

William E. McBride, 49, of Tulsa, was killed recently when a time bomb exploded prematurely at an oil well lease near Kellyville, Okla. He had been with Dowell Incorporated 10½ years.

George W. Williams, 74, longtime driller and oil producer, died recently at his home in Franklin, Pa.

J. M. Cooper, 69, 30-year veteran of Carter Oil Co.'s production department in Cromwell, Okla., died recently in Muskogee, Okla. He retired from Carter 4 years ago.

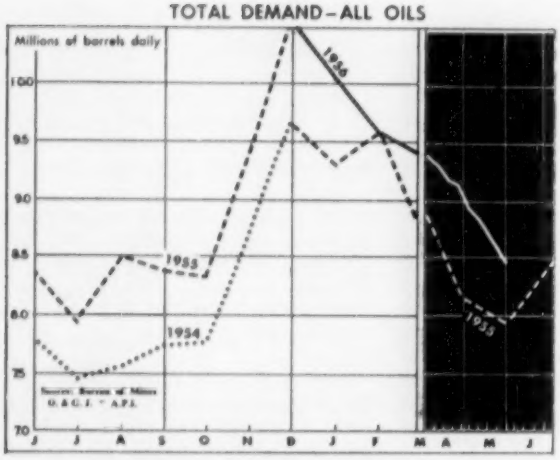
Philip E. Johnson, 55, former vice president of Olympic Refining Co., Long Beach, Calif., and later president of a Roseburg, Ore., oil firm, died recently in Pasadena, Calif.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,043,840	DOWN	18,150	UP	449,818
Crude stocks	278,136,000	UP	1,912,000	DOWN	3,776,000
Completions	1,193	UP	73	UP	114
Refinery runs	8,072,000	UP	275,000	UP	507,000
Gasoline stocks	184,870,000	UP	1,360,000	UP	15,885,000
Kerosine stocks	21,879,000	UP	1,180,000	DOWN	4,465,000
Distillate stocks	77,399,000	UP	5,372,000	DOWN	6,946,000
Residual stocks	35,836,000	UP	1,049,000	DOWN	8,523,000
Four-product stocks	319,984,000	UP	8,961,000	DOWN	4,049,000
Total imports	1,045,600	DOWN	480,900	DOWN	29,200

TOTAL DEMAND—ALL OILS



End-of-June Crude Stocks May Be Highest in 2 Years

REPORTED schedules of crude imports for June plus estimates of crude production point to further increases in crude stocks during the month.

Starting with April, domestic crude production averaged about the same as in March. Crude imports dropped about 85,000 bbl. daily, representing the net reduction in crude supply. Weekly reports indicated an increase in crude stocks of about 12,000,000 bbl. for the month or 400,000 bbl. daily.

For the month of May, domestic crude production was cut back about 120,000 bbl. daily, but crude imports increased almost 140,000 bbl. daily for a small net gain in new crude supply. Increased use of crude at refineries was not enough to prevent another gain in crude stocks, estimated at about 150,000 bbl. daily for the month of May.

For the month of June, importers' reports to the Texas Railroad Commission show a planned increase in crude imports of 66,000 bbl. daily. Production from new wells will tend to offset part of the announced reduction in allowables. These and other adjustments tend to limit the reduction in domestic production to 50,000 bbl. daily or less. The over-all changes represent a small net increase in new crude supply compared with May.

Since crude stocks increased about 150,000 bbl. daily in May, the further small gain in supply for June will result in a surplus of a little more than 150,000 bbl. daily which will be available for either higher refinery runs or further additions to inventories.

There will be no need for increased refinery runs in June. Gasoline inventories on June 1 were 15,885,000 bbl. higher than a year ago. Kerosine and distillate stocks are below last year's levels, but there will be plenty of time to increase light-fuel inventories after the end of June. Residual stocks are down, but no one wants to run extra crude to produce more heavy fuel.

If refinery runs for June are held down to the May level, the resulting increase in crude stocks of 150,000 bbl. daily would amount to about 1,000,000 bbl. per week. Total crude stocks amounted to 278,000,000 bbl. on May 26. Gains of 1,000,000 bbl. per week would raise the total to 283,000,000 bbl. by the end of June.

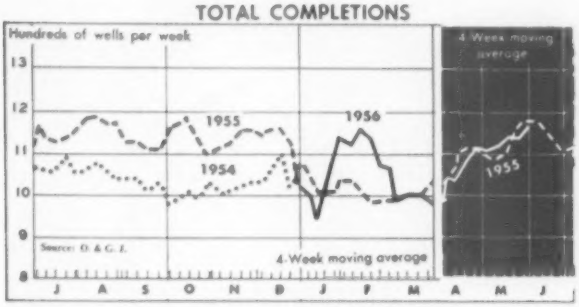
Distillate markets are strong . . . Esso Standard Oil Co. announced an increase of 0.15 cent a gallon in its cargo prices for light heating oils for Baltimore and other points along the North Atlantic seaboard. The new prices became effective June 2 and were due to continuing high tanker rates.

Very little activity has been reported recently in the Gulf Coast distillate market. East Coast stocks were reduced enough this spring to provide storage space for the summer surplus, but high tanker rates will tend to discourage spot purchases on the Gulf Coast to be sold on the East Coast.

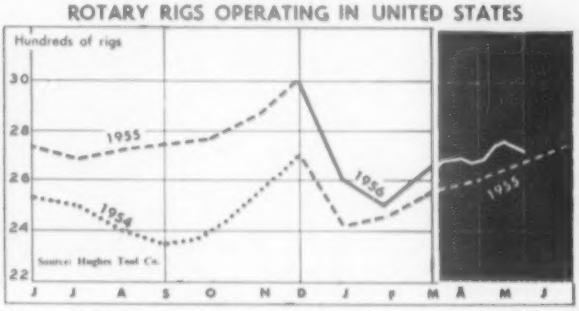
The prolonged heating season in the North Central states resulted in distillate sales out of pipeline terminals through May. Some Group 3 suppliers are predicting firm distillate prices through the summer.

Esso Standard Oil Co. increased its gasoline prices to dealers in Arkansas and Tennessee by an average of 0.8 cent a gallon. The service-station price war in Kansas City has spread to other points in northwestern Missouri.

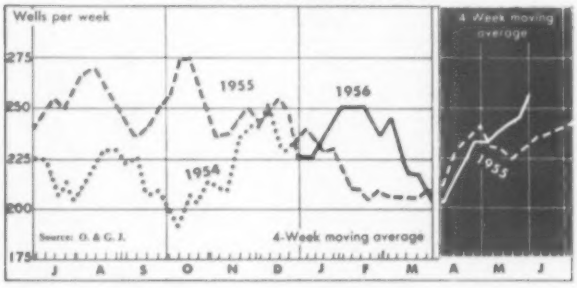
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	6-4-56	5-28-56	6-6-55
North Central and East	126	125	166
Southeast	29	29	39
Okla., Kans., Ark., Mo.	462	475	525
Louisiana	452	441	416
North and East Texas-Panhandle	432	436	416
Gulf and South Texas	249	251	248
West Texas-New Mexico	564	553	525
Rocky Mountain	274	251	265
Pacific Coast	120	112	150
Total United States	2,708	2,673	2,750
Western Canada	226	220	158

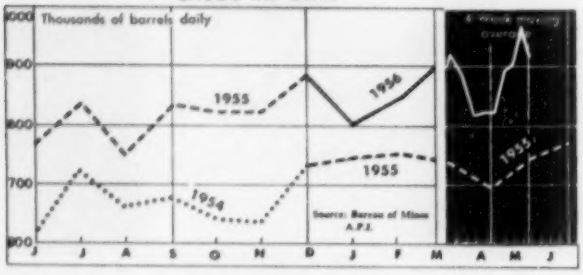
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JUNE 2, 1956

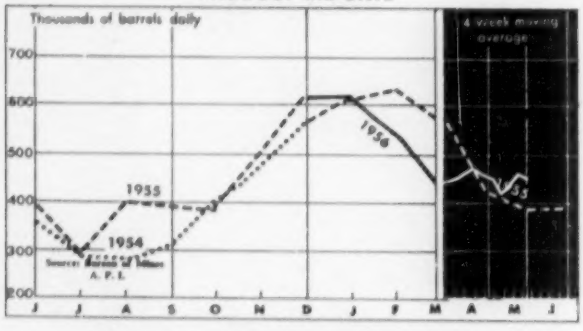
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1956				
	Comp.	Oil	Gas	Dry	Footage	1956	1955	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	2	1	0	1	17,833	42	39	0	0	0	1	1	0	0	1	21	22
Arkansas	13	9	0	4	35,855	324	310	0	0	0	2	2	15	0	2	50	67
California	40	34	1	5	139,901	906	1,100	0	0	1	3	4	17	0	3	172	192
Colorado	26	12	2	12	139,136	495	573	3	0	0	9	12	14	0	6	211	231
Illinois	57	26	0	31	143,547	1,478	1,509	0	0	0	12	12	25	0	0	248	273
Indiana	20	8	0	12	40,931	262	322	1	0	0	8	9	9	0	1	50	60
Kansas	98	48	5	*45	341,092	2,124	2,167	4	0	1	20	25	52	1	11	374	438
Kentucky	33	16	1	16	41,307	690	528	2	0	0	10	12	17	0	1	154	172
Louisiana	76	40	7	29	555,867	1,613	1,710	3	1	1	10	15	48	29	28	217	322
North	28	16	1	11	73,356	619	919	1	0	0	3	4	11	1	1	79	92
South	36	16	6	14	400,745	792	791	0	1	1	7	9	30	25	18	123	196
Offshore	12	8	0	4	81,766	202		2	0	0	0	2	7	3	9	15	34
Michigan	7	4	0	3	16,893	187	213	0	0	0	1	1	4	0	0	62	66
Mississippi	4	1	0	3	26,786	183	203	0	0	0	3	3	7	0	1	71	79
Montana	6	1	0	5	21,459	138	134	0	0	0	3	3	5	0	0	36	41
Nebraska	24	8	0	16	136,448	407	292	0	0	0	11	11	16	0	0	187	203
New Mexico	73	27	26	20	281,153	777	612	2	0	0	12	14	22	0	5	71	98
Northwest	33	0	26	7	112,760	292	170	0	0	0	6	6	2	0	5	22	29
Southeast	40	27	0	13	168,393	485	442	2	0	0	6	8	20	0	0	49	69
North Dakota	10	8	0	2	81,192	102	94	1	0	0	2	3	7	0	0	21	28
Ohio	20	10	0	†10	48,146	435	458	0	0	0	0	0	0	0	1	4	5
Oklahoma	177	118	5	154	567,171	3,706	3,652	4	0	1	19	24	56	13	16	307	392
Pennsylvania-New York	3	0	3	0	9,242	413	711	0	0	0	0	0	0	0	3	2	5
Texas	467	303	18	146	2,000,820	9,243	8,309	10	0	1	89	100	323	20	80	1,984	2,407
Southwest (1 & 4)	86	53	3	30	294,472	1,353	1,307	4	0	0	21	25	64	5	28	373	470
Gulf Coast (2 & 3)	46	24	4	18	293,856	1,145	1,092	0	0	1	9	10	28	8	32	295	363
East (5 & 6)	24	8	3	13	137,570	474	408	0	0	0	9	9	7	1	5	174	187
North Central (7-B & 9)	159	89	1	69	523,719	3,316	2,986	4	0	0	36	40	145	0	2	789	936
West (7-C & 8)	125	109	1	15	660,112	2,433	2,091	2	0	0	14	16	76	0	7	327	410
Panhandle (10)	27	20	6	1	91,091	522	425	0	0	0	0	0	3	6	6	26	41
Utah	1	0	1	0	5,050	37	28	0	0	1	0	1	1	0	2	21	24
West Virginia	23	2	19	2	64,265	286	254	0	0	0	0	0	0	0	2	5	7
Wyoming	12	6	3	3	66,481	317	328	0	0	1	2	3	7	0	5	80	92
Miscellaneous (Nev.)	1	0	0	1	7,349	57	15	0	0	0	1	1	4	0	0	44	48
Total United States	**1,193**	682	91	420	4,787,924	24,222	23,561	30	1	7	218	**256**	649	63	168	4,392	5,272
Total previous week	1,120	563	104	453	4,385,680			33	0	11	212	256	619	62	161	4,174	5,016
Total June 4, 1955	1,079	603	73	403	4,269,232			26	3	5	190	224	642	95	152	3,998	4,887
Cumulative 1956	24,222	13,358	1,603	9,261	98,876,583												
Western Canada	57	50	1	6	293,451	953											

Service wells included: *2, †1, ‡7.

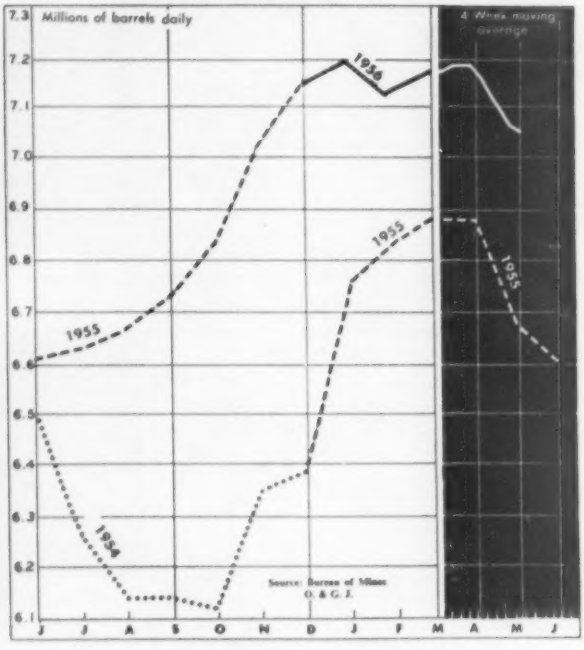
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

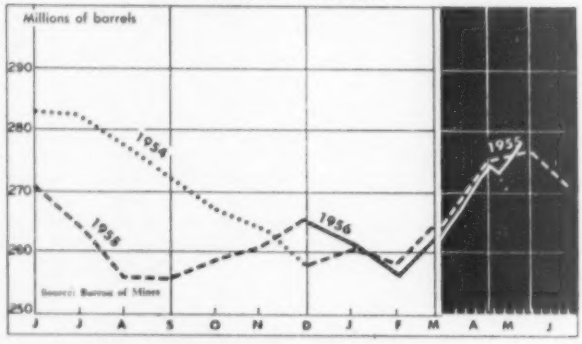


DAILY AVERAGE PRODUCTION FOR WEEK

	June 2, 1956			May 26
	Crude oil	Lease condensate	Total	total
Alabama	5,200		5,200	5,100
Arkansas	74,800	450	75,250	72,950
California	966,200		966,200	966,200
Colorado	169,200		169,200	164,200
Eastern	49,000		49,000	49,400
Florida	1,375		1,375	1,375
Illinois	227,400		227,400	228,500
Indiana	31,200		31,200	31,600
Kansas	342,200		342,200	342,400
Kentucky	48,100		48,100	48,400
Louisiana	730,100	60,400	790,500	788,250
North	122,100	2,400	124,500	122,250
South	608,000	58,000	666,000	666,000
Michigan	27,900		27,900	29,700
Mississippi	107,000	3,700	110,700	110,700
Montana	58,900		58,900	58,800
Nebraska	40,700		40,700	38,500
New Mexico	241,200	3,200	244,400	244,600
North Dakota	25,100		25,100	24,700
Oklahoma	565,100		565,100	597,200
Texas	2,924,000	51,215	2,975,215	2,975,215
Dist. 1	54,800	425	55,225	55,225
Dist. 2	150,000	8,175	158,175	158,175
Dist. 3	425,700	25,000	450,700	450,700
Dist. 4	235,000	4,900	239,900	239,900
Dist. 5	45,000	450	45,450	45,450
Dist. 6	122,000	5,850	127,850	127,850
East Texas field	209,500		209,500	209,500
Dist. 7-B	152,000	50	152,050	152,050
Dist. 7-C	185,000	4,005	189,005	189,005
Dist. 8	1,042,000	1,800	1,043,800	1,043,800
Dist. 9	209,000	400	209,400	209,400
Dist. 10	94,000	160	94,160	94,160
Utah	5,200		5,200	5,300
Wyoming	284,700		284,700	278,600
Others	‡300		‡300	300
Total U. S.	6,924,875	118,965	7,043,840	7,061,990
Change from previous week, down			18,150	
Canada	†376,480		†376,480	385,600
Total U. S. production January 1-June 2			§1,105,886,930 bbl.	
Same period last year (crude plus cond.)			*1,041,112,540 bbl.	

*Includes 17,489,175 bbl. condensate. †Week ended previous Monday. ‡Nevada. §Revised.

CRUDE-OIL STOCKS



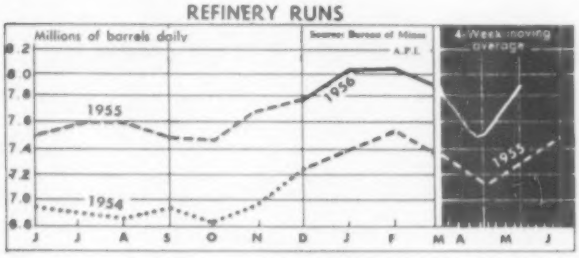
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

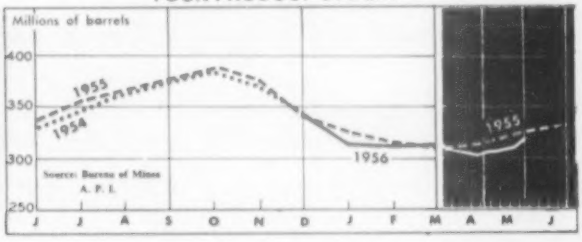
	5-26-56	5-19-56	5-28-55
Pennsylvania Grade	2,683	2,669	2,863
Other Appalachian	2,371	2,229	2,158
Illinois, Indiana, Michigan	10,801	10,609	13,353
Nebraska, North Dakota	2,348	2,410	2,678
Kansas	8,987	9,147	8,685
Oklahoma	28,196	27,200	25,593
Arkansas	3,143	3,039	3,043
Louisiana	16,343	16,729	16,447
North	2,711	2,542	2,742
South	13,632	14,187	13,705
Mississippi	2,990	2,936	2,927
New Mexico	7,693	7,541	8,822
Texas	126,008	126,743	128,809
East Texas proper	9,049	9,256	9,953
West Texas	62,248	62,150	58,082
Texas Gulf	22,701	22,883	26,410
Other Texas	32,010	32,454	34,364
Wyoming	17,629	17,240	15,906
Other Rocky Mountain	6,389	6,093	5,162
California	27,970	27,446	31,979
Foreign	†14,585	14,193	13,487
Total	278,136	276,224	281,912

*Bureau of Mines. †Includes 3,053,000 bbl. in California.

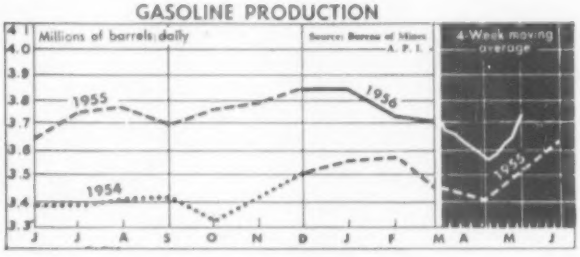
REFINERY RUNS



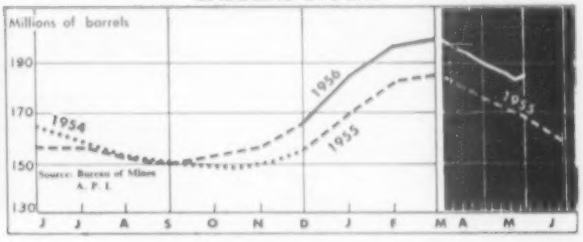
FOUR-PRODUCT STOCKS



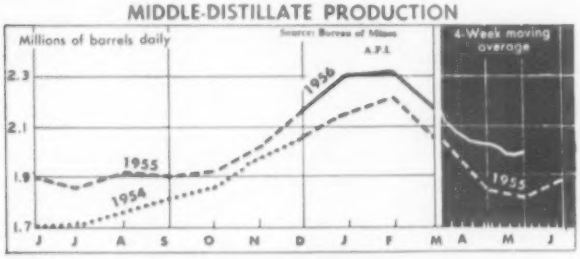
GASOLINE PRODUCTION



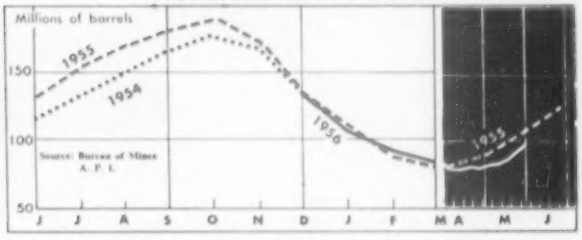
GASOLINE STOCKS



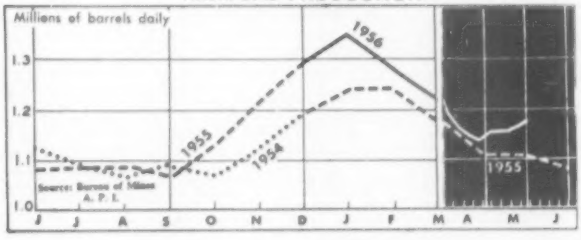
MIDDLE-DISTILLATE PRODUCTION



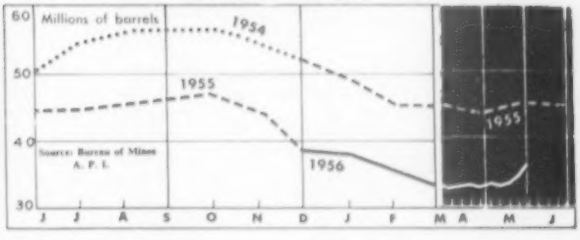
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, JUNE 1

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, June 1955 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,052	430.3	27.0	240.7	186.7	40,778	8,260	21,519	8,843	1,026	421.9	27.4	253.9	176.7
Appalachian:														
District 1	110	45.1	1.9	27.1	9.1	4,545	401	1,322	349	91	34.3	2.9	20.9	4.6
District 2	111	57.3	3.0	22.1	15.7	2,950	553	782	236	100	50.3	4.0	13.2	10.7
Ind., Ill., Ky.	1,416	720.8	68.6	280.8	172.8	34,268	3,711	10,850	4,003	1,404	748.5	63.0	259.3	165.0
Minn., Wis., Dak.	94	45.3	7.4	27.3	9.9	6,396	495	3,191	267	(§)	(§)	(§)	(§)	(§)
Okla., Kans., Mo.	719	383.9	10.6	163.9	31.6	17,333	1,051	7,520	1,109	704	414.4	19.9	153.5	30.3
Inland Texas	282	198.1	3.0	61.6	21.3	6,731	425	1,665	1,403	247	176.4	8.1	47.5	20.4
Texas Gulf Coast	2,077	954.7	106.6	494.1	271.0	24,828	3,205	11,292	5,047	1,811	845.7	91.8	435.1	241.2
La. Gulf Coast	731	355.3	37.7	184.9	60.0	9,859	2,566	5,815	1,719	675	338.6	36.6	188.1	51.4
N. La. and Ark.	101	30.9	7.6	21.3	5.0	4,481	476	1,326	86	95	35.3	6.1	24.2	6.1
Rocky Mountain:														
New Mexico	22	11.6		3.9	2.7	366	4	89	8	23	10.6	0.5	3.7	3.2
Other Rocky Mtn.	279	140.6	4.8	65.0	39.3	7,445	307	2,419	816	268	119.3	3.9	61.4	33.1
California	1,078	514.4	4.4	204.4	363.3	24,890	425	9,609	11,950	1,040	447.8	5.3	167.2	337.0
June 1, 1956	8,072	3,888.3	282.6	1,797.1	1,188.4	184,870	21,879	77,399	35,836	7,484	3,643.1	269.5	1,628.0	1,079.7
May 25, 1956	7,797	3,664.1	251.7	1,731.6	1,148.9	183,510	20,699	72,027	34,787					
June 3, 1955	7,565	3,567.6	308.4	1,691.1	1,127.7	168,985	26,344	84,345	44,359					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and pipelines. §Included with Ind., Ill., Ky.

Crude-oil and refinery prices at representative U. S. and foreign points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):

Regular (88 octane)	11.75-12.00
Premium (96 octane)	13.50-13.75

Gulf Coast (cargoes for coastwise or export movement):

Regular (90 octane)	12.25-11.50
Regular (92 octane)	11.50-12.00
Premium (97 octane)	13.00-13.25
Premium (98 octane)	13.25-13.75

California—Los Angeles (rack):

Regular (84 octane)	12.9-13.40
Premium (93 octane)	14.0-14.25

Caribbean area (cargoes):

Regular (87 octane)	10.50
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:

Grade 26-70	4.5

Breckenridge:

Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):

Kerosine 42-44	10.00-10.25
Diesel oil (58 d.i. and above)	9.625-9.875
Distillate No. 1	9.625-9.875
Distillate No. 2	9.00-9.25

Gulf Coast (cargoes):

Kerosine 41-43	95
Distillate No. 2	8.75-9.25

New York Harbor (barges):

Kerosine 41-43	10.85
Distillate No. 2	10.35
Diesel fuel, 48-52 d.i.	10.65

Caribbean area (cargoes):

Distillate No. 2	8.75

WAX (LB.)

Oklahoma (Group 3):

132-135 A.m.p. (semi-refined) in tank cars	6.50

New York (export):

126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.00-2.10
Gulf Coast (cargoes):	
Bunker C fuel	$2.10
New York Harbor (barges):	
Bunker C fuel	$2.65
Caribbean (cargoes):	
Bunker C at Aruba, N.W.I.	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.10-2.20

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
★ 145-155 vis. at 210, bright stock, 8 color, 25 p.t.	26
★ 200 vis. neutral (180 at 100°), 25 p.t.	23

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.02				
15-15.9	2.08				
16-16.9	2.13				
17-17.9	2.19				
18-18.9	2.24				
19-19.9	2.30				
20-20.9	2.35	$2.50		$2.37	
21-21.9	2.41	2.52		2.39	
22-22.9	2.47	2.54		2.41	
23-23.9	2.52	2.56		2.43	
24-24.9	2.58	2.58	$2.91	2.45	
25-25.9	2.64	2.60	2.93	2.47	$2.13
26-26.9	2.69	2.62	2.95	2.49	2.19
27-27.9	2.76	2.64	2.97	2.51	2.24
28-28.9	2.83	2.66	2.99	2.53	2.29
29-29.9	2.91	2.68	3.01	2.55	2.34
30-30.9	2.97	2.70	3.03	2.57	2.39
31-31.9	3.04	2.72	3.05	2.59	2.44
32-32.9	3.12	2.74	3.07	2.61	2.48
33-33.9	3.20	2.76	3.09	2.63	2.52
34-34.9	3.27	2.78	3.11	2.65	2.56
35-35.9	3.34	2.80	3.13	2.67	2.60
36-36.9	3.39	2.82	3.15	2.69	2.64
37-37.9		2.84	3.17	2.71	2.66
38-38.9		2.86	3.19	2.73	2.68
39-39.9		2.88	3.21	2.75	2.70
40 and up		2.90	3.23	2.77	2.72

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas. †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, February 7, 1956; east of California, June 15, 1953; Pennsylvania Grade, May 16, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.45
Middle District	4.32
Southwest Pennsylvania	4.03
West Virginia	3.91
Buckeye Grade	3.85
Zanesville Grade	3.10
Illinois Basin	**3.00**
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.8°, Tucupido	*3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	*2.80
Tia Juana medium, 26.5°-26.9°, Amuay	†2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.46
Iraq, 36.0°-36.9°, Tripoli, Banias	2.46
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES (PER LONG TON)

(Latest reported spot fixtures)

★N.W.I.-U.S.N.H., dirty (USMC+70%)	$4.59
★N.W.I.-U.K., dirty (MOT+105%) (66s. 8d.)	9.34
★P.G.-U.K., dirty (Scale+110%) (113s. 7d.)	15.91
★P.G.-U.K., dirty (MOT+107.5%) (112s. 1d.)	15.70

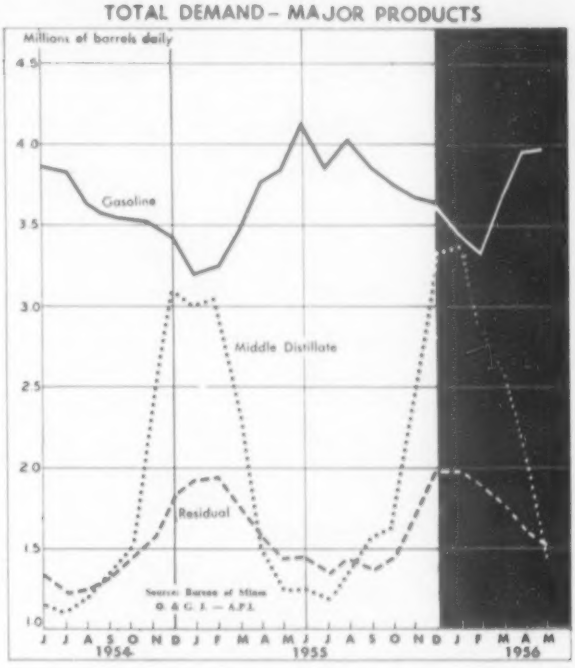
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

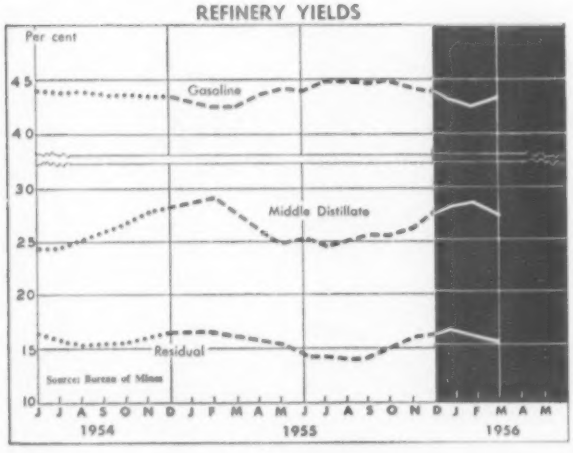
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
May 1956*	3,992	3,712	184,870
April 1956*	3,974	3,581	189,773
March 1956	3,738	3,734	199,698
June 1955	4,446	3,643	157,439
May 1955	3,836	3,518	168,751
KEROSINE			
May 1956*	176	293	21,879
April 1956*	286	310	18,089
March 1956	395	342	17,215
June 1955	154	269	29,830
May 1955	138	296	26,375
DISTILLATE			
May 1956*	1,279	1,704	77,399
April 1956*	1,719	1,720	62,809
March 1956	2,173	1,808	60,846
June 1955	1,080	1,628	100,652
May 1955	1,099	1,519	83,559
RESIDUAL			
May 1956*	1,511	1,170	35,836
April 1956*	1,615	1,140	32,793
March 1956	1,755	1,213	32,984
June 1955	1,457	1,080	44,398
May 1955	1,444	1,110	45,083

*Preliminary. †Thousands of barrels.

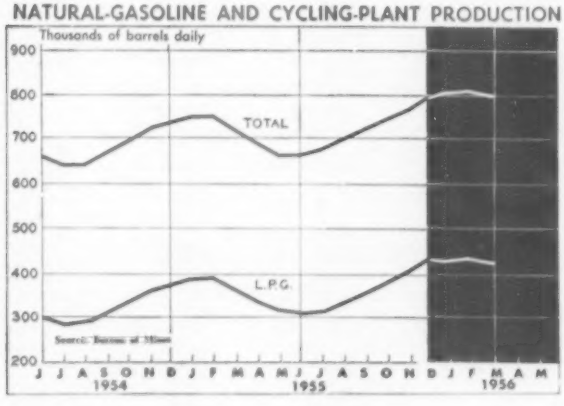
TOTAL DEMAND – MAJOR PRODUCTS



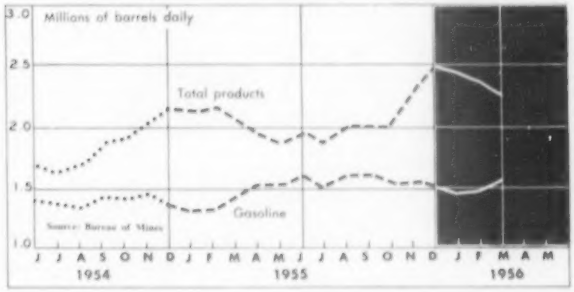
REFINERY YIELDS



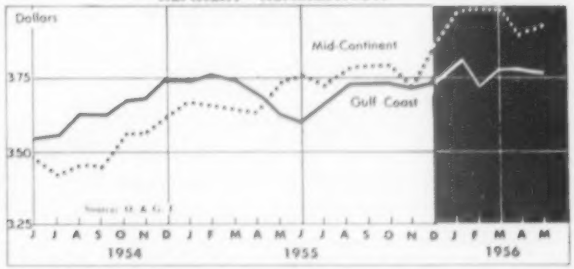
NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



PRODUCTS DELIVERED BY PIPELINE



REFINERY REALIZATION



REFINERY REALIZATION

	May* 1956	April* 1956	March 1956	May 1955
Mid-Continent	$3.94	$3.90	$3.91	$3.73
Gulf Coast	3.77	3.78	3.78	3.63

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel oil, and residual as published in The Oil and Gas Journal.

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210 WICHTEX SPUDDER three drum unit 150 horsepower Hall-Scott Engine completely overhauled includes Kohler 1500 watt light plant, ¾" wireline, ⅝" sandline. Mounted on trailer. Contact B. J. Graham, 1112 West Eleventh. Phone 133OR Okmulgee. $2500.

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20—Brown fintube exchangers, 600# 11, 21, 77, 101, 140 sq. ft.
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WANTED for oilfield equipment sales position; man experienced in drilling and production equipment with sales and administrative ability to work in New York with established manufacturers' export representative. Some foreign travel. Submit detailed resume of qualifications including experience, education, personal data and salary requirements. All replies confidential. Box J-558, The Oil and Gas Journal, Tulsa, Oklahoma.

Petroleum Geologists

Established Oil Company desires geologists for employment in West Texas area. Must know area and have four to six years of active experience in subsurface mapping and interpretation. Excellent opportunity for advancement. Salary will be commensurate with ability and experience. Reply should state age, education, experience, and salary desired.

BOX J-485,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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HELP WANTED

PROCESS ENGINEER: Graduate petroleum or chemical engineer with a maximum of two years experience connected with refining operations. Excellent opportunity for advancement with a large independent refinery in the Southwest area. Salary according to qualifications. Box J-546, The Oil and Gas Journal, Tulsa, Oklahoma.

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Several graduate engineers with minimum 5 years' experience supervising maintenance engineering functions in oil refining or producing facilities, power plants, heavy industrial installations, manufacturing plants or related operations. To establish technical supervision, procedures, maintenance operations and schedule routine and special work for major oil producing and refining operation with all supporting facilities; i.e., housing, feeding, recreation, etc.

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PETROLEUM ENGINEERS

Active independent oil company has vacancies for graduate petroleum engineers with two to five years of practical experience in drilling and production in West, West Central or North Texas. Excellent opportunities for growth and advancement. Replies should furnish complete personal data, education, experience, and starting salary desired.

BOX J-569,

THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

DRILLING ENGINEER

Major drilling company has opening in its general offices for young graduate petroleum engineer to work with manager of operations. Age limit 35. Must have field experience in Mid-Continent areas and be familiar with drilling techniques and machinery. In replying give past employment record, experience, and education. All replies confidential.

Box J-574,

The Oil and Gas Journal,

Tulsa, Oklahoma.

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HELP WANTED

CHEMIST: Graduate chemist with a maximum of two years experience connected with refining operations. Excellent opportunity for advancement with a large independent refinery in the Southwest area. Salary according to qualifications. Box J-547, The Oil and Gas Journal, Tulsa, Oklahoma.

INDEPENDENT REFINER in Mid-Continent area has opening for Assistant Plant Superintendent. Prefer graduate engineer with minimum of 5 years experience in the operation of vacuum and atmospheric distillation equipment. Box J-543, The Oil and Gas Journal, Tulsa, Oklahoma.

RESERVOIR ENGINEERS with minimum of four years experience wanted by expanding medium sized major oil company. Staff positions are in southwest locations. Please furnish information on degree held, detailed experience and state salary expected. All replies held confidential. Box J-536, The Oil and Gas Journal, Tulsa, Oklahoma.

VALUATION ENGINEER

Oil Company seeking to purchase producing oil properties desires services of petroleum engineer with experience in reservoir valuation and appraisal work. In addition to practical technical knowledge and experience, must have ability to make and develop contacts. Some experience in the ABC economics of financing purchases also desirable. This is a permanent salaried position with excellent opportunities for growth. Written reply should furnish details on education, experience, age, personal and professional references, and some idea of salary requirements. Small recent photo would be helpful.

Box J-528, The Oil and Gas Journal,
Tulsa, Oklahoma.

w

MECHANICAL ENGINEER

Graduate Mechanical Engineer with minimum of three years experience in oil refinery engineering. Must be capable of performing general refinery engineering work and aid in development of design specifications for refinery processing equipment.

Duties will be closely integrated with operations of new independent refinery which includes crude distillation, catalytic cracking, polymerization, coking and utilities.

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Saint Paul 1, Minnesota

PETROLEUM ENGINEERS

Graduate Petroleum Engineers with 2 - 6 years' experience wanted by Major Oil Company for work in Mid-Continent and Gulf Coast areas. Openings available for Reservoir and Field Production Engineers. In first reply give resumé of experience, date available, and salary expected.

BOX J-479, THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

HELP WANTED

ENGINEERS WANTED: By crude oil pipe line operating company for general engineering. Applicants must have recognized degree in civil, electrical, mechanical, chemical, petroleum or industrial engineering. Experience not essential. Salary based on experience and qualifications. When making application, please furnish resume of experience record, personal data, and copy of college transcript. Reply to—EMPLOYEE RELATIONS DEPARTMENT, Interstate Oil Pipe Line Company, P. O. Box 1107, Shreveport, Louisiana.

CHEMICAL ENGINEERS

Expanding Houston refinery has openings for Chemical Engineers.

Send complete resume to

P. O. BOX 5008
HARRISBURG STATION
HOUSTON 12, TEXAS

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Upper Midwest Refinery has openings for Chemical Engineers with up to Five years experience in process engineering, economics or operational engineering.

Please include complete resume of experience, education, salary expected and references with reply.

International Refineries, Inc.
PERSONNEL DEPARTMENT
Box #8
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Box J-575,
The Oil and Gas Journal,
Tulsa, Oklahoma.

Plant Equipment Inspectors

Graduate engineers with minimum 5 years' experience in design or inspection of petroleum processing plants and equipment. Major part of experience must have been in inspection work entailing general knowledge of all facilities. Develop inspection methods, supervise and conduct inspections and advise operations on codes and equipment limitations in a major oil installation located in Saudi Arabia.

Write giving full particulars regarding personal history and work experience. Please include your telephone number.

Recruiting Supervisor, Box 90

ARABIAN AMERICAN OIL COMPANY

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HELP WANTED

OIL INDUSTRY Employment Service, 405 Tuloma Bldg., Tulsa, Okla. For technical, experienced oil men, under 40.

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

ENGINEER with a minimum of two years electric log experience wanted by oil reserve section of major oil company. Replies should furnish complete personal data, education, experience and starting salary desired. Box J-563, The Oil and Gas Journal, Tulsa, Oklahoma.

GAS MAN wanted to supervise construction and operate a new gas gathering and transmission system. Must have experience in operation of gathering system and compressor station. This is a permanent job. Location — Central Michigan. Somerville Construction Company, Ada, Michigan.

RESERVOIR ENGINEER: Position with large international petroleum engineering company in Engineering and Consulting Department. Engineering degree plus three years or more experience in various phases of petroleum engineering. Work will involve reservoir studies, evaluation and development work on wide variety of active fields. Salary commensurate with ability; company benefits; opportunity for advancement. Location: Dallas. Box J-565, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE PETROLEUM ENGINEER, for Secondary Recovery Section of Engineering and Consulting firm. Require 3 to 5 years experience, principally in water flooding work. Chief duties will involve evaluation of water flood prospects and performance. Base location: Dallas. Box J-566, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL OR Chemical Engineers: Immediate openings for recent college graduates, mechanical or chemical engineering, for training in refinery engineering including inspection, staff and supervisory work in plant maintenance and construction. Excellent employee benefits program. Address letter stating education, experience, and salary requirements to Personnel Division, Continental Oil Company, Ponca City, Oklahoma.

OIL COMPANY WANTS ENGINEERS

Excellent opportunity with well-known, aggressive company. Employment openings in Great Bend, Kansas and Midland, Texas for Junior Engineers. Applicant should have a degree, preferably in Petroleum or Mechanical Engineering, and not over 2 years experience. Write giving age, education and salary expected. Please address

ANDERSON-PRICHARD OIL CORPORATION,
Liberty Bank Building,
Oklahoma City 2, Oklahoma,
for the attention of Mr. D. F. Tver,
Industrial Relations Department.

SITUATIONS WANTED

SUBSURFACE GEOLOGIST, 7½ yrs. Mid-Continent. Qualified to handle, geol., drill., land, prod., seismic. Major Co. and Independent Experience. Desires retainer, consider full time position. Box J-567, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE PETROLEUM ENGINEER: 36. Eleven years production, drilling, gas and reservoir engineering including reserve estimates. Texas Gulf Coast. Desire work with opportunity and responsibility. Box J-570, The Oil and Gas Journal, Tulsa, Oklahoma.

EXECUTIVE

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BOX J-544,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

SITUATIONS WANTED

EXPLORATION GEOLOGIST—Over 5 years experience in Mid-Continent and Rocky Mts., desires employment. Family man. Resume upon request. Box J-555, The Oil and Gas Journal, Tulsa, Oklahoma.

SEISMOLOGIST with twenty years experience desires geophysical work in Texas with oil company exploration department. Box J-557 The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST: MS, 32, single. 3½ years surface, development and subsurface major company experience in 4-Corners and Permian Basin. Desire challenging opportunity in Rocky Mountains or West Coast. Available July 1st. Box J-576, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST - PRODUCTION ENGINEER, married, 30, 6 years experience Appalachian area, 4 years supervisory. Surface, sub-surface geology with major. Fracturing, acidizing with service company. Desire responsible position with oil or gas producer. Box J-571, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION GEOLOGIST: 29, B.S., two years experience major company Venezuela, one year West Texas, two years small South American company as production supervisor and exploitation geologist. Speaks fluent Spanish. Married, two children, desires foreign assignment. Box J-572, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL-PETROLEUM ENGINEER, 38, family, advanced degree, eleven years in technical and practical phases of petroleum production desires a position in production or service work with an opportunity for advancement. Box J-573, The Oil and Gas Journal, Tulsa, Oklahoma.

CONTROLLER, 30, Degree, 9 years independent oil, drilling experience. Accounting, joint interest, purchasing, office supervision budgets. Aggressive, hard-working, honest. Resume on request. Box J-568, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST. Master's. 20 years of unusually varied experience in North, Middle, South America, Europe and Far East as gravity and seismic party chief and exploration supervisor. Geophysical research; geophysical-geological interpretations. Seeks position. Box J-569, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER - GEOLOGIST, qualified to direct operations of exploration-production department. Nine years experience in West and West Central Texas: evaluation, production, drilling, completions. Presently independent oil operator and producer. Desires association with large independent as executive with participation in company or represent investment group. Box J-564, The Oil and Gas Journal, Tulsa, Oklahoma.

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WANTED: Financial help to drill 100 acre lease, nine sands encountered to 1400 feet. Early Pennsylvania sand 250 feet deep, 550 feet best prospects. Wells pumping on joining lease. Atoka Co., Okla. Have Rig, Truck, Tools. Box J-537, The Oil and Gas Journal, Tulsa, Oklahoma.

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CAPITAL CONTACT. Will consider placing proposition requiring corporate financing on Underwriting basis. Confidential. Write Consultant, 817 51st St., Brooklyn, N. Y.

FOR SALE—A wonderful opportunity to buy a well established (20 years) "Cable Tool" drilling business (gas & oil) located 50 miles from Windsor, Ontario in Canada. 4 rigs capable of drilling from 1,500 to 5,000 ft., drilling and fishing tools. Trucks and a yard. Two acres of land. Two rigs running now, 2 more could be. Lots of drilling to be done. Reason for selling, ill health. Dr.'s orders. Box J-561, The Oil and Gas Journal, Tulsa, Oklahoma.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that 40 acres of land in one parcel, within the known geologic structure of Williams Park Anticline, Routt County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p.m. M.S.T., June 28, 1956, when bids will be opened. The cost of publication (advertising) must be paid by the successful bidder. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado, George H. Woodhall, Manager.

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that approximately 2556.78 acres of land in twelve parcels within the known geologic structure of Rangely Field, Rio Blanco County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 P. M., M.S.T., June 29, 1956, when bids will be opened. The cost of advertising (publication) must be paid by the successful bidder. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado, George H. Woodhall, Manager.

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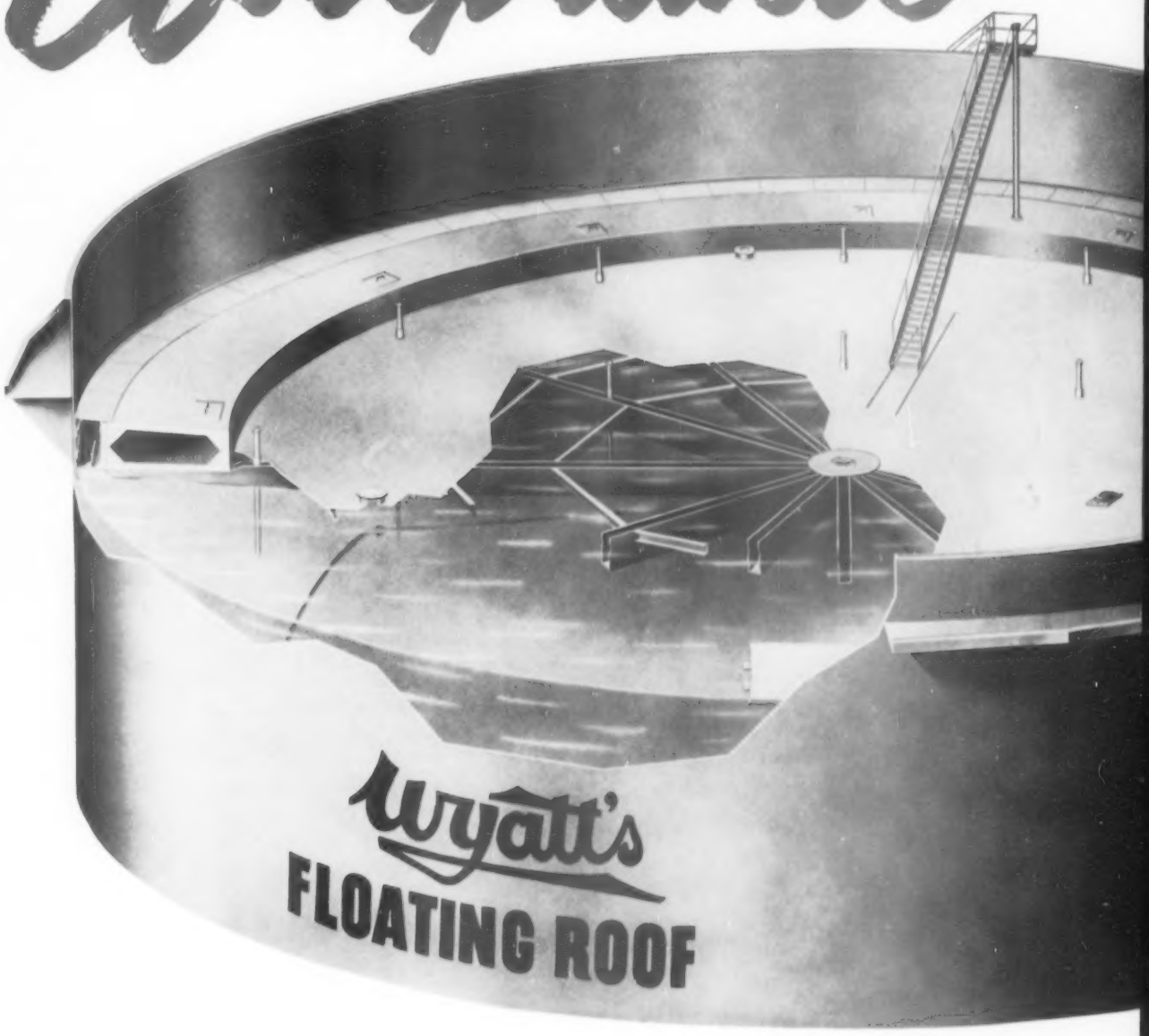

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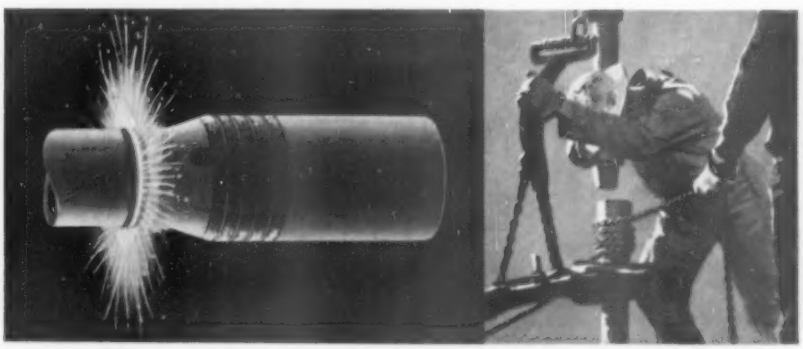

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